MULTIMEDIA SOFTWARE FOR TEACHING ABOUT BRITISH EMPIRE

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Faculty of

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_____

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in

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_____

by

Asritha Challa

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SAN DIEGO STATE UNIVERSITY

The Undersigned Faculty Committee Approves the

Thesis of Asritha Challa:

Multimedia Software for Teaching about British Empire

Carl Eckberg, Chair
Department of Computer Science

Joseph Lewis
Department of Computer Science

Edward Beasley
Department of History

Feb 24, 2011
Approval Date

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DEDICATION

I would like to dedicate my thesis to my family for their motivation, support and love.

ABSTRACT OF THE THESIS

Multimedia Software for Teaching about British Empire
by
Asritha Challa
Master of Science in Computer Science
San Diego State University, 2011

British Empire is the largest empire in the history of the world ever known, influencing all over the globe. It had massive impact on the history of world, dominating for two centuries and comprising about one quarter of the land area during the late 19th and early 20th centuries.

Motivation for this thesis is to develop an interactive GIS application to help students learn British Empire history by utilizing modern computer technology. Studies prove that students learn much more when they learn in an interactive way than by reading or listening. This software is developed keeping in mind both teachers and students, so that both are benefited. This software displays some points on the world map, which are read from CSV (Comma Separated Values) files. The CSV files which will have the corresponding information about countries ruled by British. Based on the initial year of British rule, countries have been divided into three categories 18th, 19th and 20th century. Students can click on these countries with the help of hotlink tool and see the interesting information displayed on a window. A wiki link is given on this window that is different for each point or country. Through this wiki link students have access to more interesting information about the British Empire related to the country. Images, videos, web links etc will be there in the wiki link, which will be useful for students to study the history.

This software is made with the help Map Objects Java Objects (MOJO) provided by Environmental Systems Research Institute (ESRI) and Wiki Spaces to create web pages for each country ruled by the British.

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CHAPTER 1

INTRODUCTION

Geographic Information Science (GIS) is one of the ways that combines both data and maps to display graphics where users can visualize the data and manipulate it. GIS is used for local, national and global scale in various industries for example like agriculture, forest, local housing developments, natural resources, history, population census, geography, business, education, utilities, etc. Multimedia is very helpful when used in an interactive way to teach students. Nowadays, the use of maps for representing data has been revolutionized.

GIS allows users to store, display, manipulate, analyze and link the data to the locations on the maps. The GIS tool stores the data related to maps in each layer. Each layer represents one specific type of data e.g. cities. Users can edit the layers individually or in combination of more than one layer. It saves layers of information about a place and displays the information on the map graphically, which gives users a better understanding of the place. There are many packages provided by Environmental Systems Research Institute (ESRI). Classroom usage of GIS encourages critical thinking, promote global awareness, strengthen and extend technology skills, extend and expand your curriculum, introduce students to real world technology applications, instill students with a sense of place, and create in them a sense of community [13].

This GIS tool is developed using Map Objects Java Objects (MOJO). Map Objects Java is a suite of Java based developer components for creating client or server side mapping and GIS applications [9]. NetBeans Integrated Development Environment (IDE) is used to implement the software. NetBeans IDE is a modular, standards-based, integrated development environment written in the Java programming language [10].

My thesis is about teaching the British Empire in the world, that is developed using GIS software making it easy for teachers to teach and simultaneously making it interesting for the students to learn about British history in an interactive way. In this thesis, for each country ruled by the British, a webpage is prepared using wiki spaces. The web pages can be easily modified. For this two shape files are taken, one is world and the other is country.

The shape files are the ones, which are used to display the world map with countries bordered on the tool (Graphical User Interface). The data is all about the countries that were ruled by the British Empire. The countries are divided into three categories 1700s, 1800s and 1900s depending on the year of start of the British Empire in their country. This data is represented in comma separated value files (i.e. CSV files). So both the shape files and CSV files acts as the input or data files for the tool. The web pages, which are linked through CSV files, contain information about the British Empire in their respective countries. Some of the web pages also contain images, html links, you tube videos, etc.

This thesis report contains seven chapters. Chapter two explains about the requirements for the software. Chapter three is about the technologies used to build this software. Chapter four is about analysis of the software. Chapter five is about the data collection, preparation and organization of data. Chapter six discusses about the implementation of the software and all the features of the tool that are helpful to the users. Chapter seven discusses about the scope for the future enhancement of this software.

CHAPTER 2

TECHNOLOGIES USED

The technologies used in the development of this software are Java and Environmental Systems Research Institute's (ESRI) ArcGIS software. GIS here stands for Geographic Information Systems. Java is used since it is one of the hottest technologies presently used in the software industry. Java is robust and it is simple to learn for those who know C/C++ as it built based upon them. Java technology's versatility, efficiency, platform portability and security make it the ideal technology [7]. This software can be run on any hardware platforms and operating systems as it is developed using Java that is platform portable. As Java is free software any one can easily download it and use it. Graphical User Interface (GUI) of this software is built using java's Abstract Windowing Toolkit (AWT) mixed with swings. AWT is a general interface between Java and the native system, used for windowing, events and layout managers [2]. Java swings are a set of class libraries that support building GUIs and graphics functionality for applications [12]. Swing gets native look and feel for the user interface. Our GIS is mainly built using Map Objects Java Edition. Map Objects Java Edition is a set of pure java components that can be used for creating GIS-enabled applications [6]. Some of the important things that we are going to discuss about Map Objects Java Edition are cited at [6]. There are two groups of components that can be used for developing GIS components. One is client-side components and the other is server side components. Client side is used for mapping user interfaces and applications and server side is used for integration with internet and enterprise applications. Map Objects essentially consists of a number of JAR files containing UI java beans (extensions to java swing) and an API of mapping components. Client side is the one that is used for this software. The following are some of the core features available through Java Edition.

- Displaying maps with dynamic, real time geographic data.
- Allowing users to navigate and zoom through map layers.
- Performing queries on spatial information.
- Performing geometric operations.

- Labeling and customizing map interfaces.

Map Objects Java Edition allows access to multiple data sources like CAD data, standard image data and GIS data types.

Alternative technologies would be MOVB, JUMP and UDIG. MOVB is visual basic based, is not free and is less portable. JUMP and UDIG are java based GIS freeware but MOJO has more built in features.

CHAPTER 3

REQUIREMENTS

This tool is developed for the use of the department of history at San Diego State University. It will be mainly used for teaching British Empire in the world by Dr. Edward Beasley, Associate Professor of Modern British History at San Diego State University. This tool is developed according to Edward Beasley's needs. Software development guidance is given by my thesis chair, Dr. Carl Eckberg from the San Diego State University, Computer Science Department.

The following are the requirements for my thesis:

1. The platform requirements given by Dr. Carl Eckberg are to use GIS Tool with Map Objects Java Edition.
2. To have any interesting and informational images, videos, html links, books etc in the information displayed that are related to the British Empire.
3. Information about the British Empire in each country that was ruled by British.
4. Information about when the British rule started and ended approximately in each country.
5. Information about important events, movements, wars etc for each country under the British Empire.
6. Provide links to data related to the British Empire that are available on the internet, like Wikipedia and other informational sites.
7. Information about whether a country is part of Commonwealth of Nations or not.
8. To divide the countries into three categories, depending on the British Rule in 1700s, 1800s and 1900s and represent them on the map with different colors.
9. The input data is read from CSV files that can be added by users.
10. When the user clicks on these points, all the information mentioned should be displayed on a window for each point on the map.
11. The tool should be user friendly and explain about all the functional capabilities of the tool in the help, which includes options like zoom in, zoom out, pan, add layers, print the maps, help, measure distance between any two points on the map etc.
12. The tool should also explain about how to add the labels, change the colors of the points displayed on the map and also shape of the points displayed.
13. The tool should be able to run on different platforms.

14. The links provided should open in any of the available browsers on the machine when clicked on them.
15. The tool should be easy to download and install from a website.

CHAPTER 4

ANALYSIS

I have analyzed all the requirements and came up with these steps to develop the software:

1. Prepare a list of all the countries that were and are under the British Rule.
2. Collect all the required data for each country that is to be displayed.
3. Prepare wiki pages for each country that was under the British Rule.
4. The content of wiki pages should be easy to modify. The user can delete or add the content, if he finds any interesting stuff to add or delete any unwanted stuff.
5. Develop the code to read input files (CSV) and display as points on the map. Each input file is added as a layer on to the map. Each layer should get different color for its points on the map.
6. When the user clicks on the points displayed, a window should pop up with information related to the British Empire corresponding to that point or country.
7. The links displayed on the window should be opened in any browser when clicked by the user.
8. Provide help page explaining the different functionalities of the tool and how to use the functionalities.
9. Provide user manual about how to get started with the tool (see Appendix).

CHAPTER 5

COLLECTION AND PREPARATION OF DATA

This thesis required a large amount of data to be collected, as the British Empire is very vast.

As for my study searching through the information about the British Empire in the World, I could list 84 different countries that were ruled by the British. I prepared wiki pages for each of these countries with related information to the British Empire in that country. Professor Edward Beasley (Department of History) and Professor Carl Eckberg (Department of Computer Science) helped me in collecting data about the British Empire. All the wiki page links that I have prepared for the countries are listed in the Table 5.1.

Table 5.1 Wiki Page URLs

Country	URL
Afghanistan	http://britishempire-afghanistan.wikispaces.com
Anguilla	http://britishempire-anguilla.wikispaces.com
Antigua and Barbuda	http://britishempire-antiguaandbarbuda.wikispaces.com
Aruba	http://britishempire-aruba.wikispaces.com
Australia	http://britishempire-australia.wikispaces.com
Bahamas	http://britishempire-bahamas.wikispaces.com
Bahrain	http://britishempire-bahrain.wikispaces.com
Bangladesh	http://britishempire-bangladesh.wikispaces.com
Belize	http://britishempire-belize.wikispaces.com
Bermuda	http://britishempire-bermuda.wikispaces.com
Botswana	http://britishempire-botswana.wikispaces.com
Brunei	http://britishempire-brunei.wikispaces.com
Burma	http://britishempire-burma.wikispaces.com
Cameroon	http://britishempire-cameroon.wikispaces.com

(table continues)

Table 5.1 (continued)

Country	URL
Canada	http://britishempire-canada.wikispaces.com
Cuba	http://britishempire-cuba.wikispaces.com
Cyprus	http://britishempire-cyprus.wikispaces.com
Egypt	http://britishempire-egypt.wikispaces.com
Falkland Islands	http://britishempire-falklandislands.wikispaces.com
Fiji	http://britishempire-fiji.wikispaces.com
Gambia	http://britishempire-gambia.wikispaces.com
Gibraltar	http://britishempire-gibraltar.wikispaces.com
Ghana	http://britishempire-goldcoast.wikispaces.com
Grenada	http://britishempire-grenada.wikispaces.com
Guyana	http://britishempire-guyana.wikispaces.com
Hawaii	http://britishempire-hawaii.wikispaces.com
India	http://britishempire-india.wikispaces.com
Indonesia	http://britishempire-indonesia.wikispaces.com
Iraq	http://britishempire-iraq.wikispaces.com
Ireland	http://britishempire-ireland.wikispaces.com
Israel	http://britishempire-israel.wikispaces.com
Jamaica	http://britishempire-jamaica.wikispaces.com
Jordan	http://britishempire-jordan.wikispaces.com
Kenya	http://britishempire-kenya.wikispaces.com
Kiribati	http://britishempire-kiribati.wikispaces.com
Kuwait	http://britishempire-kuwait.wikispaces.com
Lesotho	http://britishempire-lesotho.wikispaces.com
Malawi	http://britishempire-malawi.wikispaces.com
Malaysia	http://britishempire-malaysia.wikispaces.com
Maldives	http://britishempire-maldives.wikispaces.com
Malta	http://britishempire-malta.wikispaces.com

(table continues)

Table 5.1 (continued)

Country	URL
Martinique	http://britishempire-martinique.wikispaces.com
Mauritius	http://britishempire-mauritius.wikispaces.com
Nauru	http://britishempire-nauru.wikispaces.com
Nepal	http://britishempire-nepal.wikispaces.com
New Caledonia	http://britishempire-newcaledonia.wikispaces.com
New Zealand	http://britishempire-newzealand.wikispaces.com
Nigeria	http://britishempire-nigeria.wikispaces.com
Norfolk Island	http://britishempire-norfolk.wikispaces.com
Oman	http://britishempire-oman.wikispaces.com
Pakistan	http://britishempire-pakistan.wikispaces.com
Papua New Guinea	http://britishempire-papuanewguniea.wikispaces.com
Philippines	http://britishempire-philippines.wikispaces.com
Pitcairn Island	http://britishempire-pitcairn.wikispaces.com
Qatar	http://britishempire-qatar.wikispaces.com
Reunion	http://britishempire-reunion.wikispaces.com
St Helena	http://britishempire-sainthelena.wikispaces.com
St Kitts	http://britishempire-saintkitts.wikispaces.com
Seychelles	http://britishempire-seychelles.wikispaces.com
Sierra Leone	http://britishempire-sierraleone.wikispaces.com
Singapore	http://britishempire-singapore.wikispaces.com
Solomon Islands	http://britishempire-solomonislands.wikispaces.com
Somalia	http://britishempire-somalia.wikispaces.com
South Africa	http://britishempire-southafrica.wikispaces.com
Sri Lanka	http://britishempire-srilanka.wikispaces.com
St Lucia	http://britishempire-stlucia.wikispaces.com
St Vincent	http://britishempire-stvincent.wikispaces.com
Sudan	http://britishempire-sudan.wikispaces.com

(table continues)

Table 5.1 (continued)

Country	URL
Suriname	http://britishempire-suriname.wikispaces.com
Swaziland	http://britishempire-swaziland.wikispaces.com
Tanzania	http://britishempire-tanzania.wikispaces.com
Thailand	http://britishempire-thailand.wikispaces.com
Tonga	http://britishempire-thailand.wikispaces.com
Trinidad and Tobago	http://britishempire-trinidadandtobago.wikispaces.com
Tuvalu	http://britishempire-tuvalu.wikispaces.com
UAE	http://britishempire-uae.wikispaces.com
Uganda	http://britishempire-uganda.wikispaces.com
USA	http://britishempire-usa.wikispaces.com
Vanuatu	http://britishempire-vanuatu.wikispaces.com
Western Samoa	http://britishempire-westernsomoa.wikispaces.com
Yemen (Aden)	http://britishempire-aden.wikispaces.com
Zambia	http://britishempire-zambia.wikispaces.com
Zimbabwe	http://britishempire-zimbabwe.wikispaces.com

A base map of the world is taken to present all this data. The world map will be in the shape file format that is one of the GIS formats. Shape files are a simple, non-topological format for storing the geometric location and attribute information of geographic features [1]. More Information on shape files can be found at [5]. The shape file of world is taken from the “data” folder that will be in the Map Objects folders. After we got the world map we need to prepare CSV files. I have divided all these countries into three categories 1700s, 1800s and 1900s, depending upon the starting year of the British Empire in each country. I have prepared CSV files for all these three categories with the information of location i.e. latitude and longitude and other information like country name, web link and if the country is part of common wealth or not. A screen shot of CSV file for the 1700s is shown in Figures 5.1. Screen shot of the CSV file for the 1800s is shown in Figures 5.2. Screen shot of the CSV file for the 1900s is shown in Figure 5.3. The CSV files are the input files for the tool.

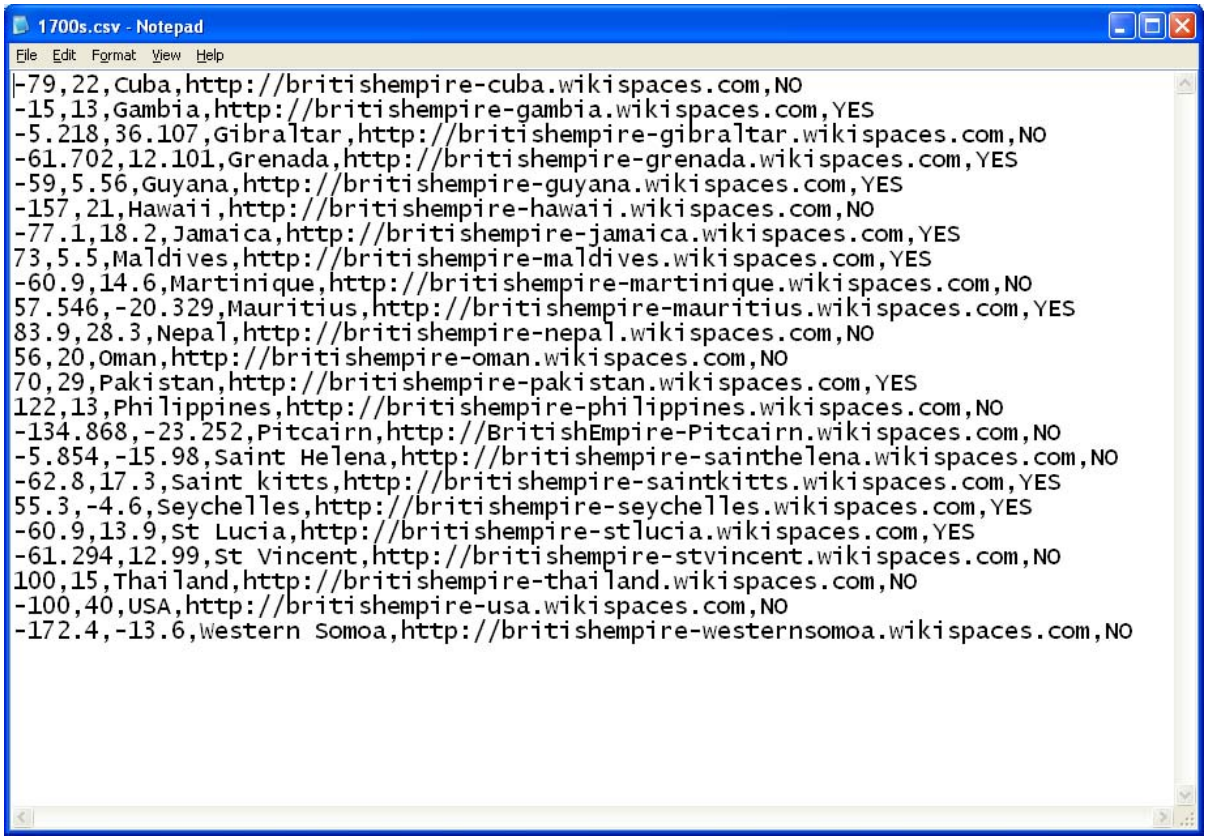

Figure 5.1. Screenshot of 1700s CSV file.

Figure 5.2. Screenshot of 1800s CSV file.

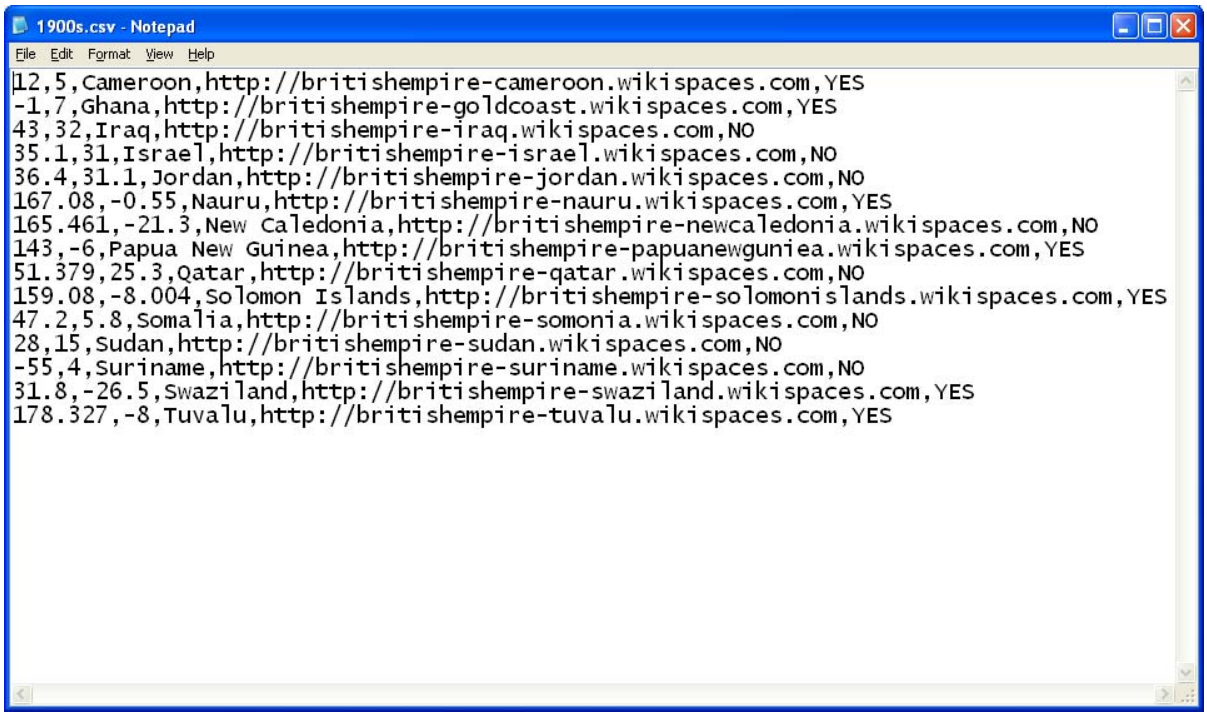

Figure 5.3. Screenshot of 1900s CSV file.

The information from the CSV files will be read and converted into layers on the map with points in each layer. The points we get depend on the latitudes and longitudes given in those files. When we click on these points on the map we get a window popped up with the information particular to that country and other general information about the British Empire in the World. The general information includes the image in Figure 5.4 to show the peak stage of the British Empire. The image can be found at [3]. The general information also includes [8, 14, 16].

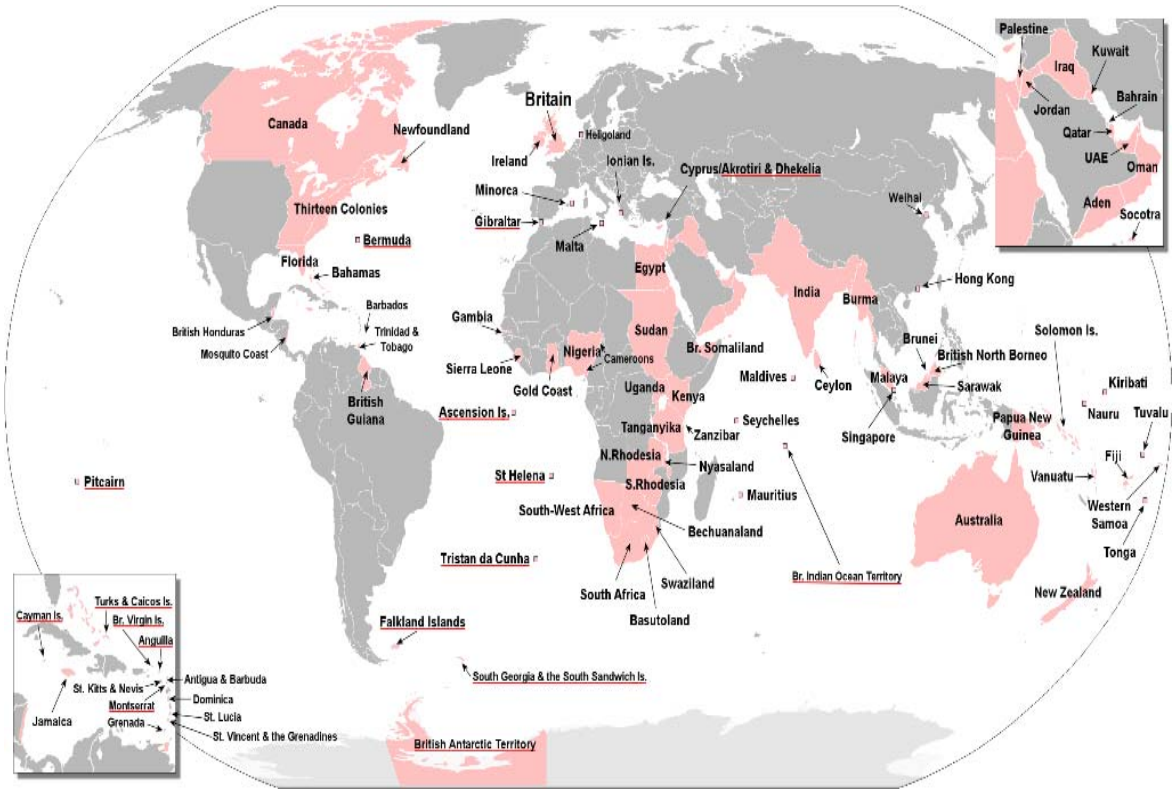

Figure 5.4. Map of the British Empire at its peak.

CHAPTER 6

DEVELOPMENT OF SOFTWARE AND ITS FEATURES

6.1 IMPLEMENTATION

This software is platform independent and it can run on any machine, as Java is platform independent. NetBeans is used to develop the software. NetBeans is open source software available at [11]. NetBeans is a powerful GUI builder supports a sophisticated yet simplified Swing Application Framework and Beans Building [15]. As Map Objects consists of JAR files, which contains UI java beans (extensions of Swings), it will be easy to import all the tool's libraries or JAR files into a new project on Net Beans. The next thing is to read the CSV files and creating points/stars on the map. This is attained using the XY tool.

The functionality for the XY tool is to read the data from the CSV file and then convert the data into a layer of points and add it to the map. So need to implement a provision to choose the CSV file using the file browser. We should read longitude, latitude, country name, wiki link and common wealth information for each point from the CSV file. We need to store the information read for each point into some data structure, so that we can use this information later. The following code allows users to select a CSV file by opening a file dialog and then reads the data from the chosen CSV file. The longitude and latitudes are read and converted into points and are added into a base points array.

```
class AddXYtheme extends JDialog/*start of class AddXYtheme extends
JDialog*/
{
    Map map;
    JFileChooser jfc = new JFileChooser();
    BasePointsArray bpa = new BasePointsArray();
    java.text.DecimalFormat df = new java.text.DecimalFormat("0.00");
    String country[] = new String[100];
    String hotlink[] = new String[100];
    String cmnwlth[] = new String[100];
    AddXYtheme() throws IOException
    {
```

```
setBounds(100,100,520,430);
File dirInit = new File("C:\\ESRI\\MOJ20\\British Empire\\");
jfc.setCurrentDirectory(dirInit);//initial folder
jfc.showOpenDialog(this);

try
{
    File file = jfc.getSelectedFile();
    FileReader fred = new FileReader(file);
    String text = file.getName();
    // where the last dot is. There may be more than one.
    int dotPlace = text.lastIndexOf('.');
    if ( dotPlace >= 0 )
    {  // possibly empty
       BritEmp.CSVName = text.substring( 0, dotPlace );
    }
    BufferedReader in = new BufferedReader(fred);
    String s; // = in.readLine();
    double x,y;
    String sArr,Arr,cArr;
    int n = 0;
    int i = 0;
    while ((s = in.readLine()) != null)
    {
        StringTokenizer st = new StringTokenizer(s,",");
        x = Double.parseDouble(st.nextToken());
        y = Double.parseDouble(st.nextToken());
        sArr = st.nextToken();
        country[i]= sArr;
        Arr = st.nextToken();
        hotlink[i] = Arr;
        cArr = st.nextToken();
        cmnwlth[i] = cArr;
        bpa.insertPoint(n++,new com.esri.mo2.cs.geom.Point(x,y));
        System.out.println("Country: "+x+y+":"+country[i]);
        i++;
    }
}catch (IOException e){}
```

```
        XYfeatureLayer xyfl = new
XYfeatureLayer(bpa,map,country,hotlink,cmnwlth);
        xyfl.setVisible(true);
        map = BritEmp.map;
        map.getLayerset().addLayer(xyfl);
        map.redraw();
  public void setMap(com.esri.mo2.ui.bean.Map map1)
    {
        map = map1;
    }
}
```

The following lines of code add a new layer of points on to the map using the base points array into which we have stored the data about each point earlier. I have given the points' shape to be stars. The points or stars get a random color each time they add a CSV file to the map. This random color helps the users to differentiate between the countries of 1700, 1800 and 1900 in which the British Empire first started in those countries. The name of the layer is the same as the CSV file name as it will be confusing to keep the constant name if the user needs to add multiple CSV files as we need to add three CSV files 1700s, 1800s and 1900s. The map is shown in the Figure 6.1 after adding the CSV files.

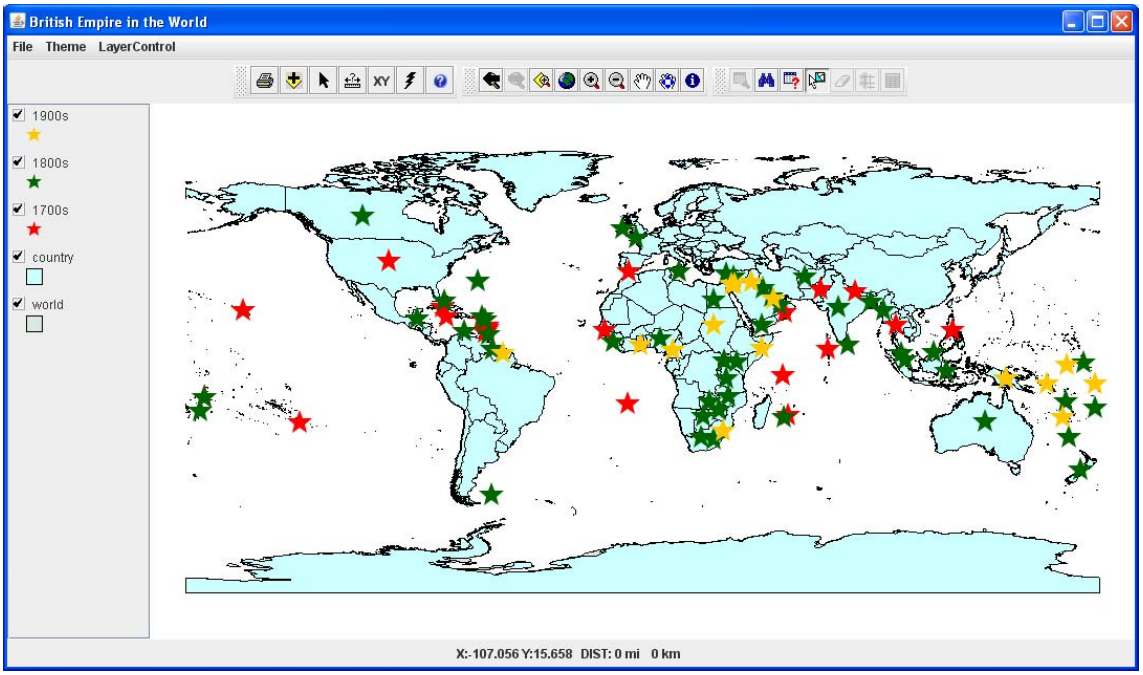

Figure 6.1. Map after adding CSV files.

```
public XYfeatureLayer(BasePointsArray bpa,Map map,String country[],String
hotlink[],String cmnwlth[])
    {
        createFeaturesAndFields(bpa,map,country,hotlink,cmnwlth);
        BaseFeatureClass bfc = getFeatureClass(BritEmp.CSVName,bpa);
        setFeatureClass(bfc);
        BaseSimpleRenderer srd = new BaseSimpleRenderer();
        BaseSimpleLabelRenderer slrd = new BaseSimpleLabelRenderer();

        SimpleMarkerSymbol sms= new SimpleMarkerSymbol();
        System.out.println("country123:"+country);
        sms.setType(SimpleMarkerSymbol.STAR_MARKER);
        Random r = new Random();
        Color  f = new Color(r.nextInt(256), r.nextInt(256),
r.nextInt(256));
        sms.setSymbolColor(f);
        sms.setWidth(15);
        TrueTypeMarkerSymbol ttm=new TrueTypeMarkerSymbol();
        ttm.setFont(new Font("British Empire",Font.PLAIN,40));
        srd.setSymbol(sms);
        setRenderer(srd);
        XYLayerCapabilities lc = new XYLayerCapabilities();
        setCapabilities(lc);
}
```

Now that we have got the CSV files added to the map, next thing is to display the information when the user clicks on these stars or points. The user should click on these points to get the information window about that point to be displayed using the Identify tool which is explained in chapter 6 section 6.2.16. If the window is not popped even if you click on the points try to zoom in to the map and click. The information window is only popped up when the click is close to the actual coordinates of the point. The pop up window contains an image of a world map showing all the areas that at one time are part of the British Empire. It also contains some informational html links and information about that particular country on which the point is present. The following code takes care of building the window with the information. It also takes care of organizing the data in the window using buttons, labels, panels, colors etc. The hot point is the bottom of the bolt.

```
public void mouseClicked(MouseEvent me)
            {
                String x1,y1;
                double x2, y2;
                double x3, y3;
                int flag = 0;
                com.esri.mo2.cs.geom.Point worldPoint = null;
                worldPoint =
map.transformPixelToWorld(me.getX(),me.getY());
                x1= df.format(worldPoint.getX());
                x2= Math.round(worldPoint.getX()*100.0)/100.0;
                y1 = df.format(worldPoint.getY());
                y2= Math.round(worldPoint.getY()*100.0)/100.0;

                for(int i=0;i<bpa.size();i++)
                {
                    com.esri.mo2.cs.geom.Point p = new
com.esri.mo2.cs.geom.Point(bpa.getPoint(i));
                    x1= df.format(worldPoint.getX());
                    y1 = df.format(worldPoint.getY());
                    x3 = Math.round(p.getX()*100.0)/100.0;
                    y3 = Math.round(p.getY()*100.0)/100.0;
                    if(( x2+2 >= x3)&&(x2-2 <=x3))
                    {
                        if(( y2+2 >= y3)&&(y2-2 <=y3))
                        {
                            flag=1;
                            //JFrame frame = new JFrame();
                            //Container cp = frame.getContentPane();
                            //cp.setLayout(new GridBagLayout());
                            JPanel jpanel_1 = new JPanel();
                            JPanel jpanel_2 = new JPanel();
                            JPanel jpanel_3 = new JPanel();
                            jpanel_1.setBackground(new
Color(255,255,255));
                            jpanel_1.setLayout(new BoxLayout(jpanel_1,
BoxLayout.Y_AXIS));
```

```
                            GridBagConstraints gbc = new
GridBagConstraints();
                            gbc.gridwidth = GridBagConstraints.REMAINDER;
                            ImageIcon image = new
ImageIcon("The_British_Empire1.png");
                            JLabel beimg = new JLabel(image);
                            JLabel t1 = new JLabel("Informative Links");
                            JButton b1 = new
JButton("http://www.britishbattles.com");

b1.setBorder(BorderFactory.createEmptyBorder(2,2,2,2));
                            b1.setHorizontalAlignment(JButton.CENTER);
                            b1.setBorderPainted(false);
                            b1.setContentAreaFilled(false);
                            JButton b2 = new
JButton("http://www.britishempire.co.uk");

b2.setBorder(BorderFactory.createEmptyBorder(2,2,2,2));
                            b2.setBorderPainted(false);
                            b2.setHorizontalAlignment(JButton.CENTER);
                            b2.setContentAreaFilled(false);
                            JButton b3 = new
JButton("http://empiretheory.fortunecity.net/VictorianLinks.htm");

b3.setBorder(BorderFactory.createEmptyBorder(2,2,2,2));
                            b3.setHorizontalAlignment(JButton.CENTER);
                            b3.setBorderPainted(false);
                            b3.setContentAreaFilled(false);

                            b1.addActionListener(new ActionListener()
                            {
                                public void actionPerformed(ActionEvent e)
                                {

OpenBrowser.displayurl("http://www.britishbattles.com");
                                  }
                            });
```

```
                            b2.addActionListener(new ActionListener()
                            {
                                public void actionPerformed(ActionEvent e)
                                {

OpenBrowser.displayurl("http://www.britishempire.co.uk");
                                }
                            });
                            b3.addActionListener(new ActionListener()
                            {
                                public void actionPerformed(ActionEvent e)
                                {

OpenBrowser.displayurl("http://empiretheory.fortunecity.net/VictorianLinks
.htm");
                                }
                            });
                            final String url = hotlink[i];
                            JButton button = new JButton(url);
                            button.setBorderPainted(false);
                            button.setHorizontalAlignment(JButton.CENTER);
                            button.setContentAreaFilled(false);
                            jpanel_2.setLayout(new
java.awt.GridBagLayout());

jpanel_2.setAlignmentX(Component.CENTER_ALIGNMENT);
                            jpanel_2.setBackground(new
Color(204,255,255));

jpanel_2.setBorder(BorderFactory.createLineBorder(Color.black));
                            jpanel_3.setLayout(new
java.awt.GridBagLayout());

jpanel_3.setAlignmentX(Component.CENTER_ALIGNMENT);
                            jpanel_3.setBackground(new
Color(255,204,100));

jpanel_3.setBorder(BorderFactory.createLineBorder(Color.black));
```

```
                            gbc.gridwidth = 1;
                           gbc.gridx = 0;
                           gbc.gridy = 0;
                           jpanel_2.add(new JLabel("Country:
",JLabel.LEFT), gbc);
                           gbc.gridx = 1;
                           jpanel_2.add(new
JLabel(country[i],JLabel.LEFT), gbc);
                           gbc.gridx = 0;
                           gbc.gridy = 1;
                           jpanel_2.add(new JLabel("X Co-ordinate:
",JLabel.LEFT),gbc);
                           gbc.gridx = 1;
                           jpanel_2.add(new JLabel(x1,JLabel.LEFT),gbc);
                           gbc.gridx = 0;
                           gbc.gridy = 2;
                           jpanel_2.add(new JLabel("Y Co-ordinate:
",JLabel.LEFT),gbc);
                           gbc.gridx = 1;
                           jpanel_2.add(new JLabel(y1,JLabel.LEFT),gbc);
                           gbc.gridx = 0;
                           gbc.gridy = 3;
                           jpanel_2.add(new JLabel("Part of Common
Wealth: ",JLabel.LEFT),gbc);
                           gbc.gridx = 1;
                           jpanel_2.add(new
JLabel(cmnwlth[i],JLabel.LEFT),gbc);
                           gbc.gridx = 0;
                           gbc.gridy = 4;
                           jpanel_2.add(new JLabel("Hot Link:
",JLabel.LEFT),gbc);
                           gbc.gridx = 1;
                           jpanel_2.add(button,gbc);
                           GridBagConstraints gbc1 = new
GridBagConstraints();
                           //gbc1.gridwidth =
GridBagConstraints.REMAINDER;
                           gbc1.gridwidth =1;
```

```
                            gbc1.gridx = 0;
                            gbc1.gridy = 0;
                            JLabel tt = new JLabel("The Areas Of The World
That At One Time Are Part Of The British Empire");
                            tt.setFont(new Font("Serif", Font.BOLD, 20));
                            jpanel_3.add(tt,gbc1);
                            gbc1.gridx = 0;
                            gbc1.gridy = 1;
                            jpanel_3.add(beimg,gbc1);
                            gbc1.gridx = 0;
                            gbc1.gridy = 2;
                            jpanel_3.add(t1,gbc1);
                            gbc1.gridx = 0;
                            gbc1.gridy = 3;
                            jpanel_3.add(b1,gbc1);
                            gbc1.gridx = 0;
                            gbc1.gridy = 4;
                            jpanel_3.add(b2,gbc1);
                            gbc1.gridx = 0;
                            gbc1.gridy = 5;
                            jpanel_3.add(b3,gbc1);
                            //mainPanel.setBackground(Color.red);
                            jpanel_1.setLayout(new BoxLayout(jpanel_1,
BoxLayout.Y_AXIS));

jpanel_1.setAlignmentX(Component.LEFT_ALIGNMENT);
                            jpanel_1.add(jpanel_2);
                            jpanel_1.add(jpanel_3,gbc);
                            JScrollPane jscrollpane = new
JScrollPane(jpanel_1);
                            JFrame frame = new JFrame("JScrollPane");
                            frame.getContentPane().add(jscrollpane);
                            frame.pack();
                            frame.setSize(400,400);
                            frame.setTitle("British Empire!");
                            System.out.println("be tool b4 frame open set
to:" +BritEmp.BETool);
                            if  (BritEmp.BETool == true)
```

```
                        {
                          frame.setVisible(true);
                        }
                        button.addActionListener(new ActionListener()
                        {
                            public void actionPerformed(ActionEvent e)
                            {
                                OpenBrowser.displayurl(url);
                            }
                        });
                    }
                }
                if(flag == 1)
                break;
            }
        }
    });
```

I have used hotlink tool to open the information windows. When the user clicks on this tool, the cursor is changed to a bolt like image as shown in the Figure 6.2. With this cursor enabled user should click on the points or stars to get the information window pop up. A sample information window when clicked on a point with identify tool is shown in the Figure 6.3.

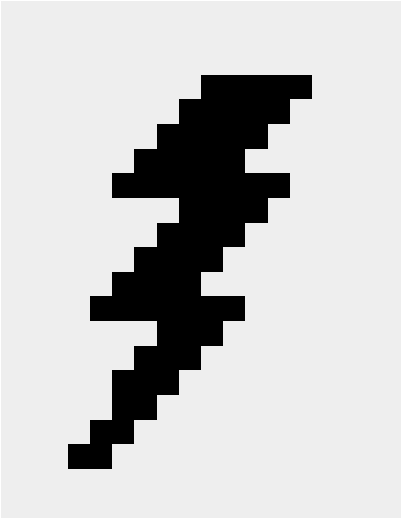

Figure 6.2. Bolt cursor.

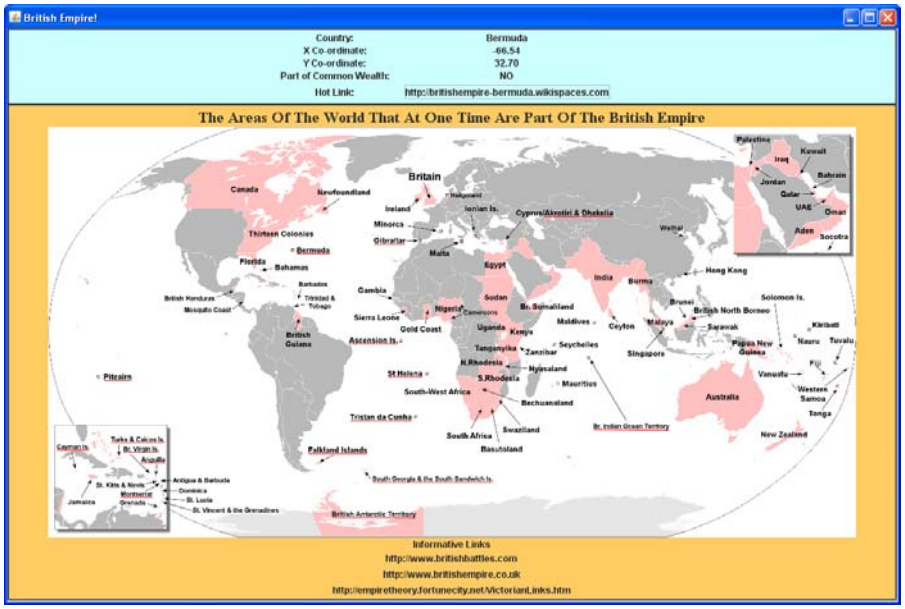

Figure 6.3. Information window when clicked on a star.

The information displayed also contains html links. The links should be opened when clicked on them from any of the available internet browsers on that type of machine. As the software is platform independent, the website links should also be opened on any machine and any available browsers on that machine. The code to open the links on a web browser, displayed on the pop window is as following. A snapshot of a sample web page is shown in the Figure 6.4.

BritishEmpire-SouthAfrica - home - Windows Internet Explorer
File Edit View Favorites Tools Help
BritishEmpire-SouthAfrica
home
PAGE
DISCUSSION
HISTORY
NOTIFY ME
PROTECTED
Join this Wiki
Recent Changes
Manage Wiki
Search
Home
Country : South Africa
British Rule : 1820-1961
Year of Independence: 1961
Brief History :
South Africa as one country came into existence in the early 1900s. Before that it had been a series of smaller countries under various colonial and independent governments. Dutch and British are the two colonial powers who held territory in South Africa.
The smaller countries fought fiercely for their independence against both the Dutch and British. The battle of the British army against the Zulus and the Boers, known as the Anglo-Boer war was especially notable. The British defeated the Zulus and later the took power of the Boer Republics and united them all with the Cape and Natal colonies to form a single country.
South Africa as one country, was called the Union of South Africa in 1911. It was self-governing, British colony.
In 1939 the National Party, supported mainly by the Afrikaners (Boers), won the national elections and started a process of moving away from British rule. There was no notable warfare or bloodshed, but a continued process of resisting British influence. In 1961, SA was granted independence from Britan and became known as the Republic of South Africa.

Figure 6.4. Screen shot of a sample wiki link.

```
public class OpenBrowser
{
   private static final String ErrorMsg = "Error trying to launch web
browser";

   public static void displayurl(String url)
   {
      String OSName = System.getProperty("os.name");
      try
      {
         if (OSName.startsWith("Mac OS")) //For Mac Operating System
         {
            Class fileManager =
Class.forName("com.apple.eio.FileManager");
            Method displayurl =
fileManager.getDeclaredMethod("dispalyurl",
            new Class[] {String.class});
            displayurl.invoke(null, new Object[] {url});
         }
         else if (OSName.startsWith("Windows")) //For Windows Operating
System
         {
            Runtime.getRuntime().exec("rundll32
url.dll,FileProtocolHandler " + url);
         }
         else //For UNIX or LINUX Operating Systems
         {
            String browser = null;
            String[] b_list = { "safari",
                                "chrome",
                                "omniweb",
                                "dillo",
                                "shiira",
                                "midori",
                                "firefox",
                                "opera",
                                "konqueror",
                                "epiphany",
```

```
                                    "mozilla",
                                    "netscape"
                                };
            for (int i = 0; i < b_list.length && browser == null; i++)
            {
               if (Runtime.getRuntime().exec(new String[] {"which",
b_list[i]}).waitFor() == 0)
               browser = b_list[i];
            }
            if (browser != null)
               Runtime.getRuntime().exec(new String[] {browser, url});
            else
               throw new Exception("Can not find internet browser");
         }
      }
      catch (Exception e)
      {
         JOptionPane.showMessageDialog(null, ErrorMsg + ":\n" +
e.getLocalizedMessage());
      }
   }
} //End of OpenBrowser
```

6.2 TOOL BAR

The tool bar of the software is as shown in Figure 6.5. We will discuss each one of the icons or buttons in detail, how to use them and what they are for.

Figure 6.5. Screen shot of the map tools of the software.

6.2.1 Print Button

This button is used to print the map. The screen shot the print button is as shown in the Figure 6.6. When you click this button you will get a window asking to select a printer and mentioning which pages to print etc. The screen shot of the window is shown in Figure 6.7. This behaves like any other normal simple print command.

Figure 6.6. Screen shot of the print button in the tool bar.

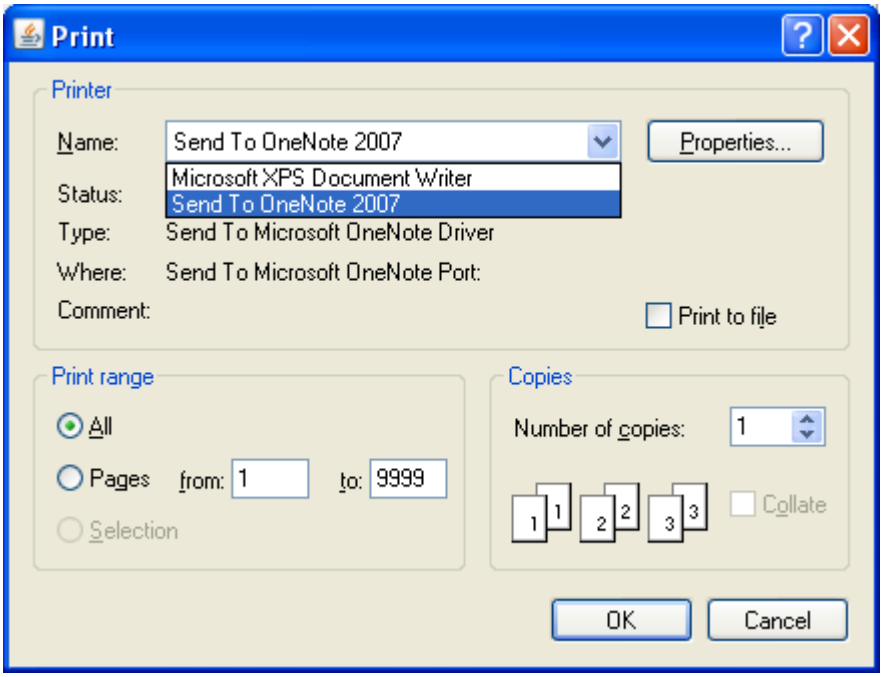

Figure 6.7. Screen shot of the print command window.

6.2.2 Add Layer

Geographic data is added to the map in the form of a layer. The data can be anything related to map like roads, cities, lakes, schools, rivers etc. One of the file formats to represent this data is a shape file. The screen shot of the Add Layer button is as shown in the Figure 6.8.

So when you click on this button you will get a dialog window asking to select a shape file as shown in the Figure 6.9. The screen shot of the map before adding any extra layer is as shown in the Figure 6.10. Now I will add cities to the world map using this tool. The screen shot of the map after adding the cities shape file is as shown in the Figure 6.11.

6.2.3 Arrow

The Arrow button gets the cursor back to normal i.e. arrow. For example when you click on the zoom in or pan button your cursor will be changed to respective tool icons and

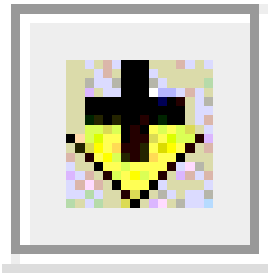

Figure 6.8. Add Layer button.

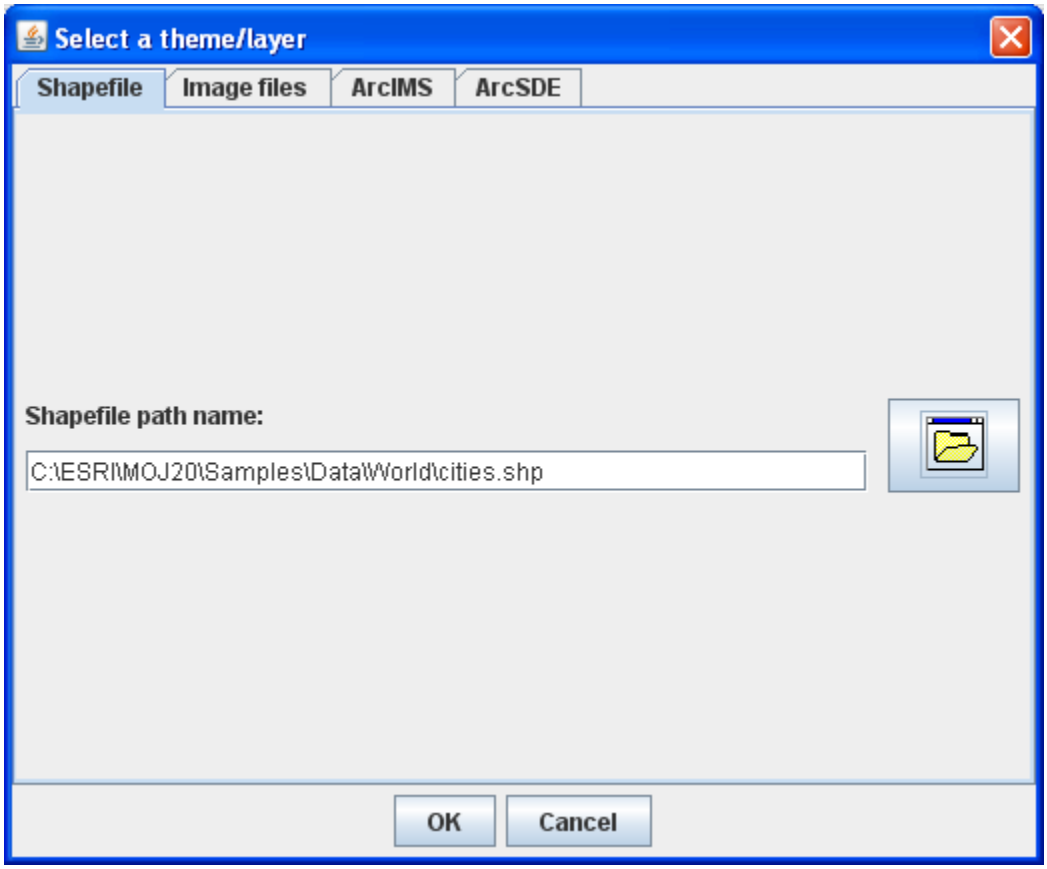

Figure 6.9. Add Layer dialog window.

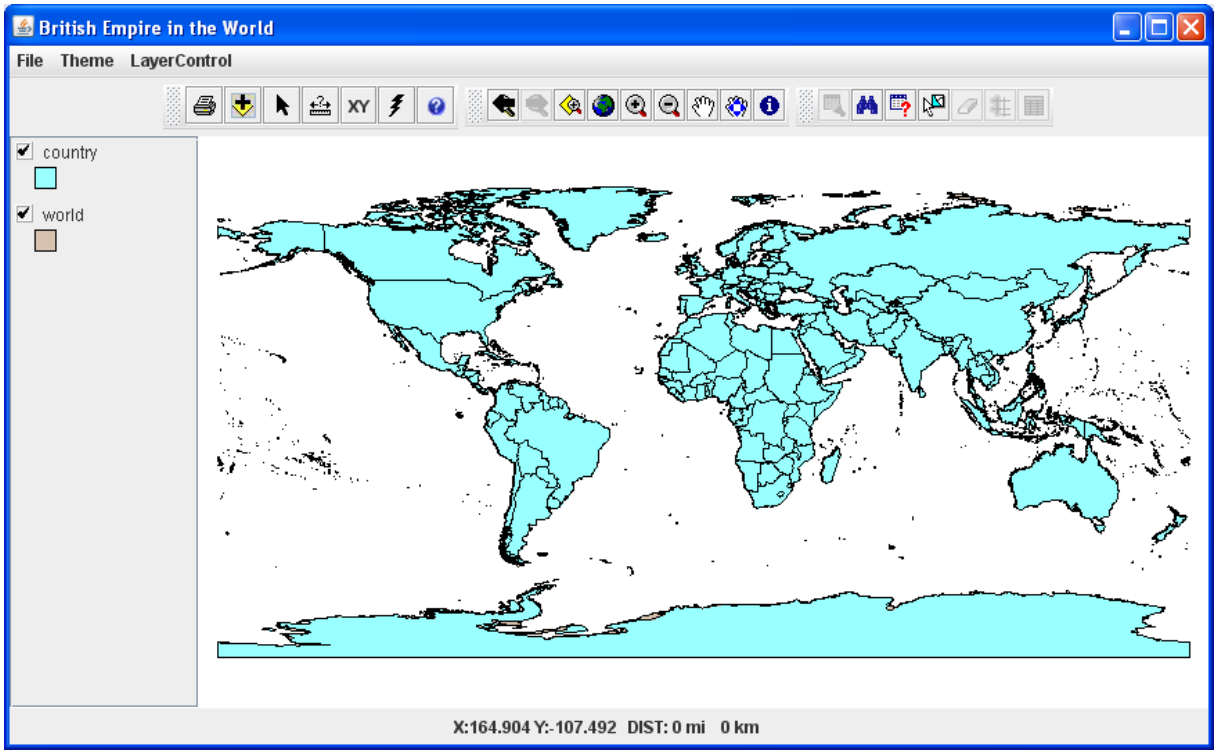

Figure 6.10. Screen shot of the map before adding any additional layers.

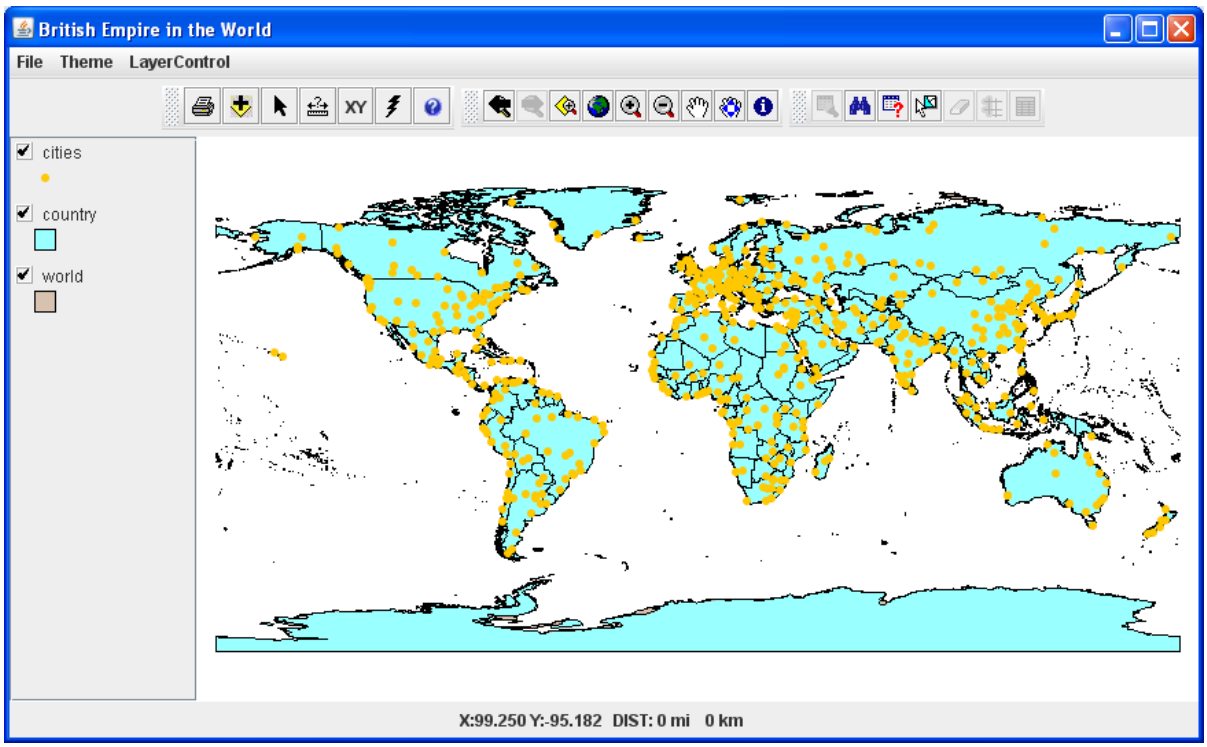

Figure 6.11. Screen shot after adding cities shape file to the map.

after using them if you want to return normal cursor icon just click on this button. The screen shot of the arrow button is as shown in the Figure 6.12.

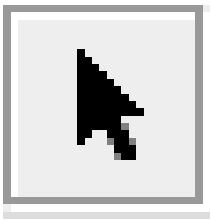

Figure 6.12. The Arrow Button.

6.2.4 Distance Measure Tool

The distance button is as shown in the Figure 6.13. This button helps us to measure the distance between two points on the map. The distance is given in both miles and kilometers at bottom of the map. Suppose you want to measure the distance between Brazil and South Africa. Simply click on this button then press on Brazil then drag it until South Africa and then release it. The screen shot demonstrating this is as shown in the Figure 6.14.

6.2.5 XY Button

The XY button is used to read the information from CSV file and then it adds a layer on to the map as points. The CSV file contains longitude, latitude and any other information values separated by commas. The icon of the XY feature tool is as shown in the Figure 6.15. Figure 6.16 shows the file dialog that opens when you click on this button. Select a CSV file and then click on ok. The screen shot of the map after selecting and adding the CSV file is as shown in the Figure 6.17.

6.2.6 Hotlink Tool

The hotlink tool is used to click on the points displayed on the map to get the information about that point on the map. The icon for the hotlink is as shown in the Figure 6.18. When you click on this icon the cursor will change to the hotlink symbol that looks like a bolt. Now click on any one of the points to get the information window. If the information window does not pop up when you click on the point try to zoom in and then click on the point. The sample information window is as shown in the Figure 6.19 when clicked on a star for country Philippines.

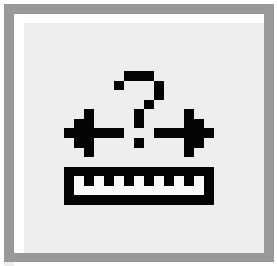

Figure 6.13. The Distance Measure button.

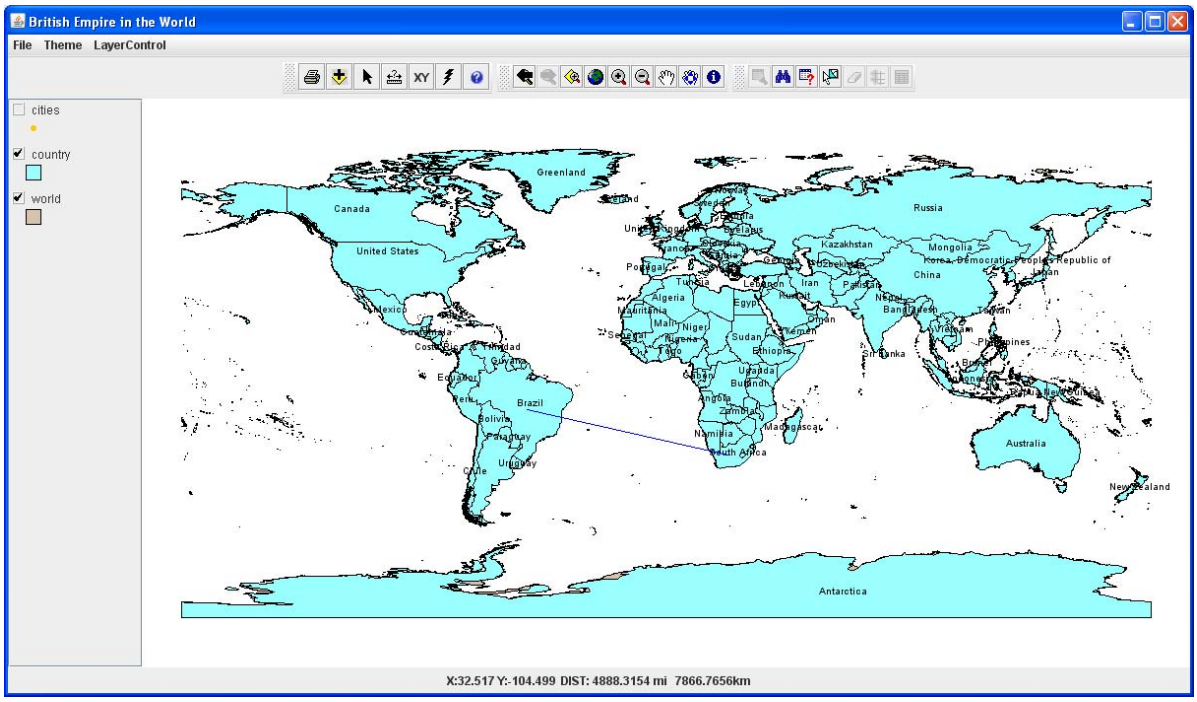

Figure 6.14. Screen shot demonstrating measuring the distance between two points.

Figure 6.15. The XY Layer button.

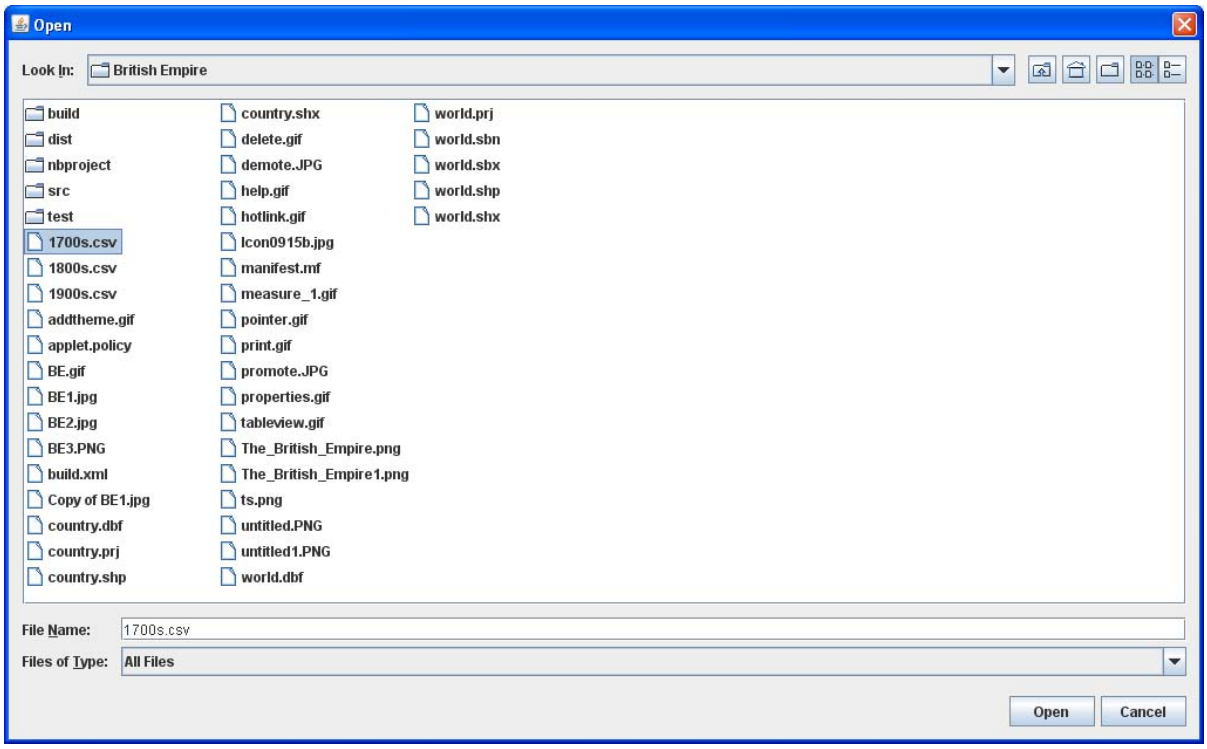

Figure 6.16. File Dialog for XY button.

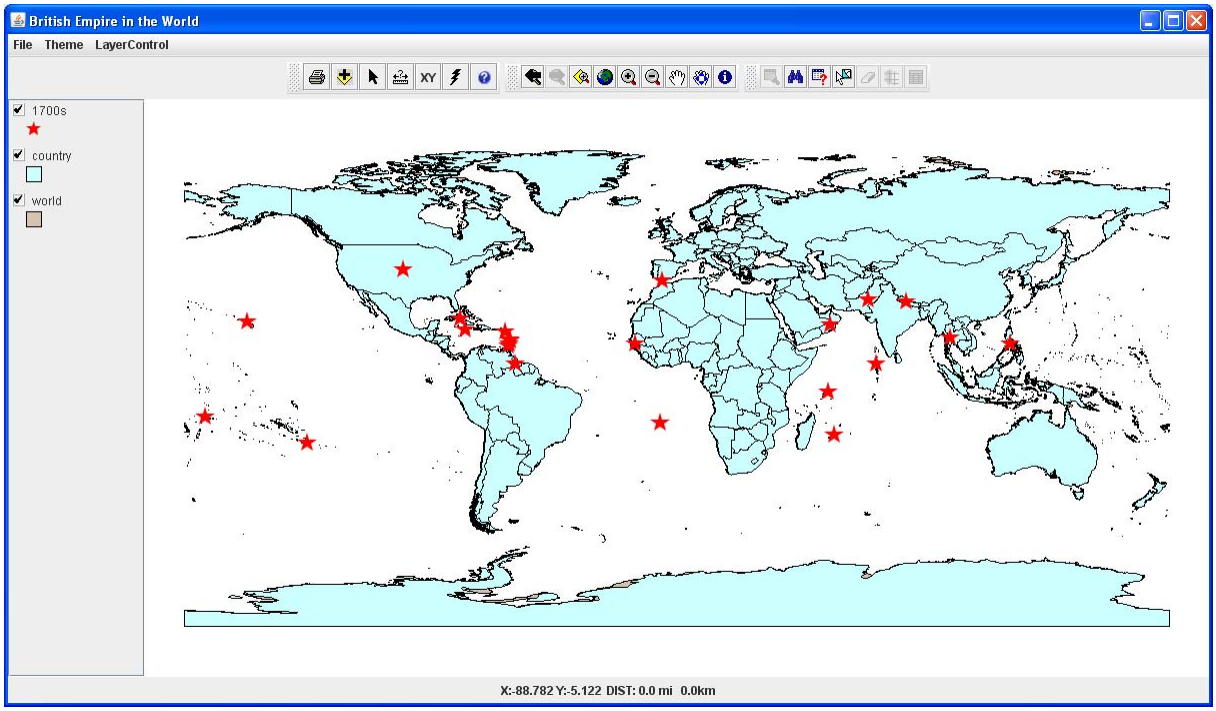

Figure 6.17. Map after adding CSV file as a layer using XY button.

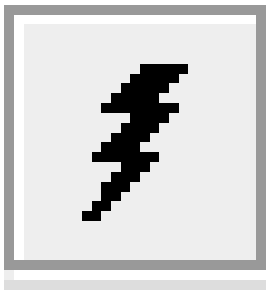

Figure 6.18. Hotlink icon.

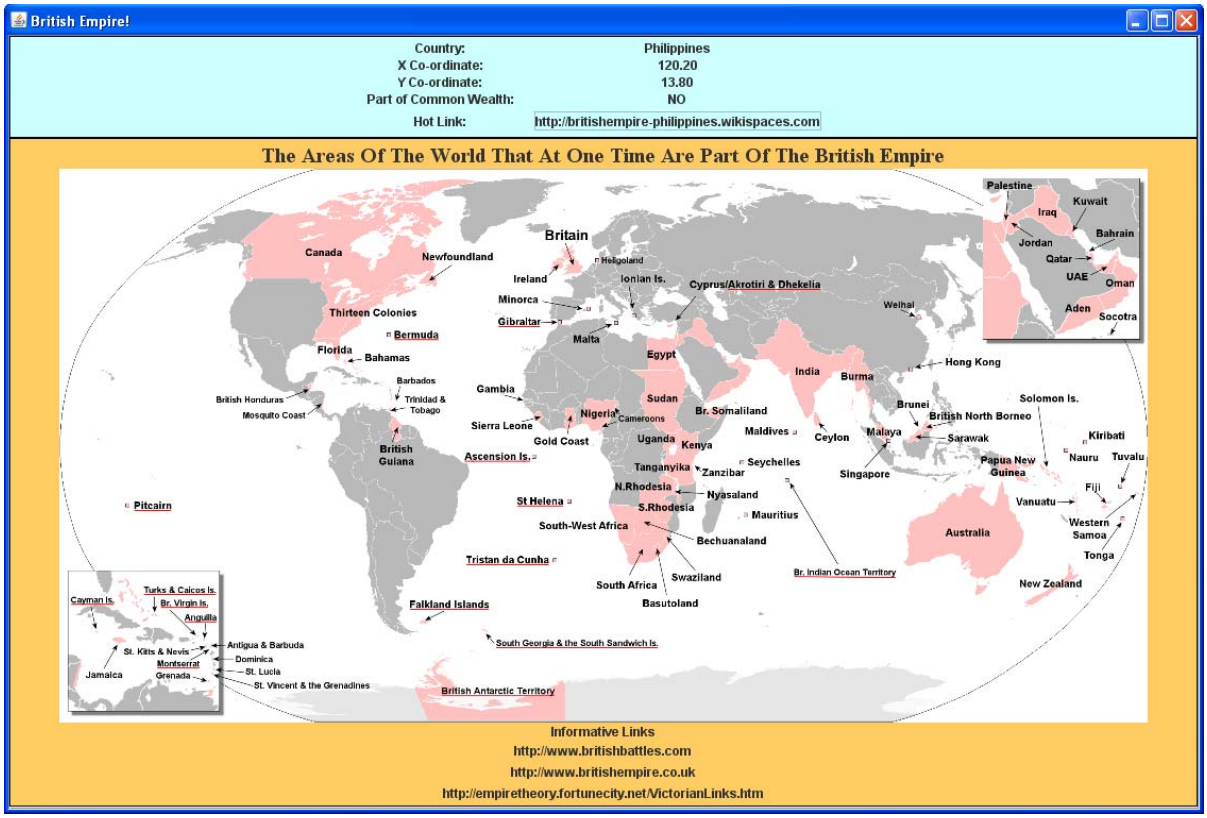

Figure 6.19. Screen shot of the window when clicked with hotlink tool.

6.2.7 Help Button

The help button gets you to the help page when clicked on. The help icon is as shown in the Figure 6.20. The universal question mark is taken as the help symbol as everybody knows it. I created a wiki link for help with all the information about the tool in it. It is also easy to update the page if anyone wants to add more information about the tool. So having question mark on the help helps them to get to this help page [4].

Figure 6.20. Help button.

6.2.8 Previous Extent

When you click on this button it takes you to the previous state of the map. The icon for previous extent is shown in the Figure 6.21.

Figure 6.21. Previous Extent icon.

6.2.9 Next Extent

When you click on this button it takes you to the next state of the map. The icon for next extent is shown in the Figure 6.22. The previous and next extents are like back and forward in the File Browser.

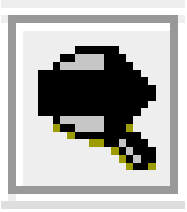

Figure 6.22. Next Extent icon.

6.2.10 Zoom to Active Layer

When you click on this button it zooms to active layer selected on the left side of the map in case you cannot see the layer. The icon for zoom to active layer is shown in the Figure 6.23.

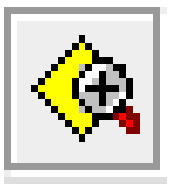

Figure 6.23. Zoom to active layer.

6.2.11 Zoom to Full Extent

When you click on this button it shows the whole map in case you zoom into the map and lose where you are and want to see the whole map again. The icon for zoom to full extent is shown in the Figure 6.24.

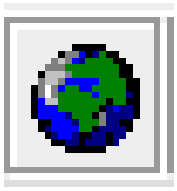

Figure 6.24. Zoom to full extent.

6.2.12 Zoom In

When you click on this button it simply zooms into the map. It also changes your cursor to zoom in icon. To get the normal cursor you need to click on arrow button. The icon for zoom in is shown in the Figure 6.25.

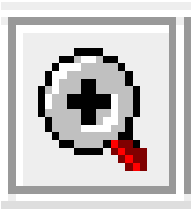

Figure 6.25. Zoom in.

6.2.13 Zoom Out

When you click on this button it simply zooms out the map. It also changes your cursor to zoom out icon. To get the normal cursor you need to click on arrow button. The icon for zoom in is shown in the Figure 6.26.

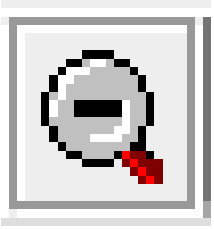

Figure 6.26. Zoom out.

6.2.14 Pan

When you click on this button you can drag the map in any direction and view it. It is just like you move the newspaper to read it. It also changes your cursor to pan icon. To get the normal cursor you need to click on arrow button. The icon for pan is shown in the Figure 6.27. Click and drag the mouse in the direction you want the view of the map.

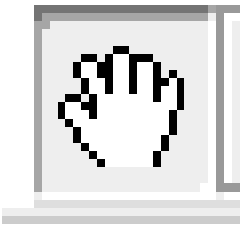

Figure 6.27. Pan.

6.2.15 Pan One Direction

When you click on this button you will see a drop down menu as shown in the Figure 6.28. Click on the north or south or west or east based upon in which direction you want to move the map. The icon for pan one direction is shown in the Figure 6.29.

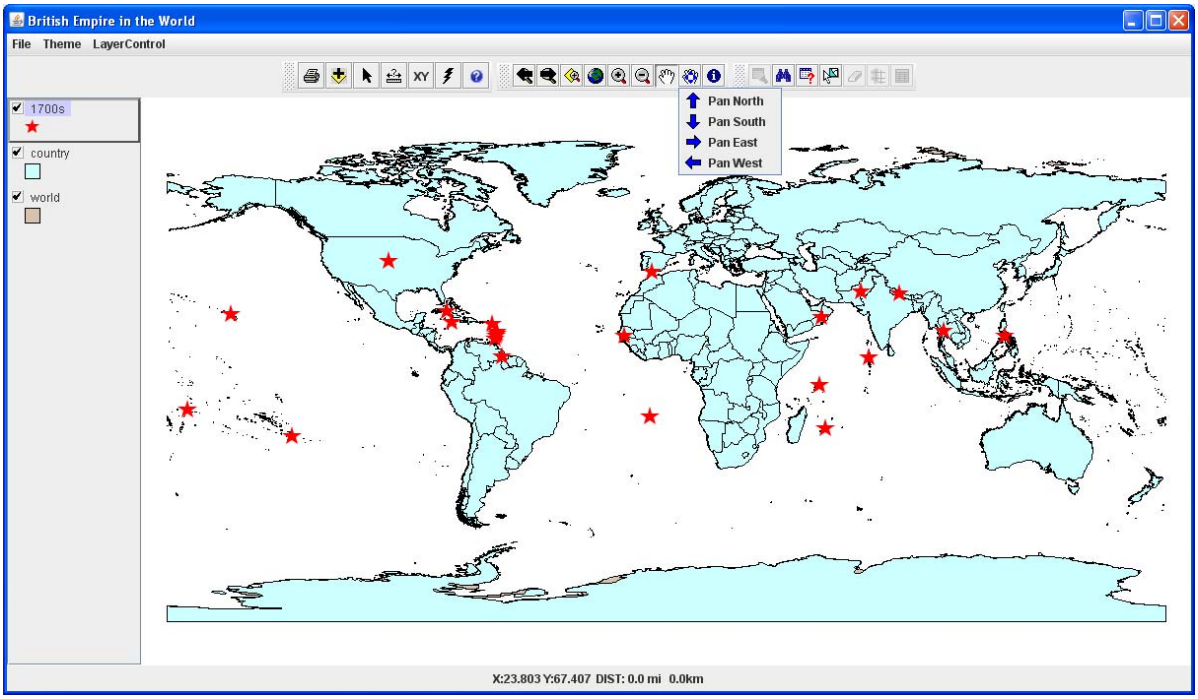

Figure 6.28. Drop down menu of the Pan One Direction.

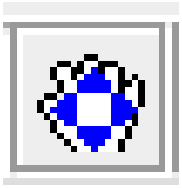

Figure 6.29. Pan One Direction.

6.2.16 Identify

When you click on this button the cursor will change to identify icon. With this you can click anywhere on the map and it pops a window with any information related to that point exists on any of the layers. The icon for identify is shown in the Figure 6.30. The screen shot of the information window is shown in the Figure 6.31. This will display information that was part of the original shape file.

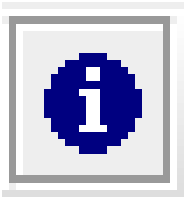

Figure 6.30. Identify tool.

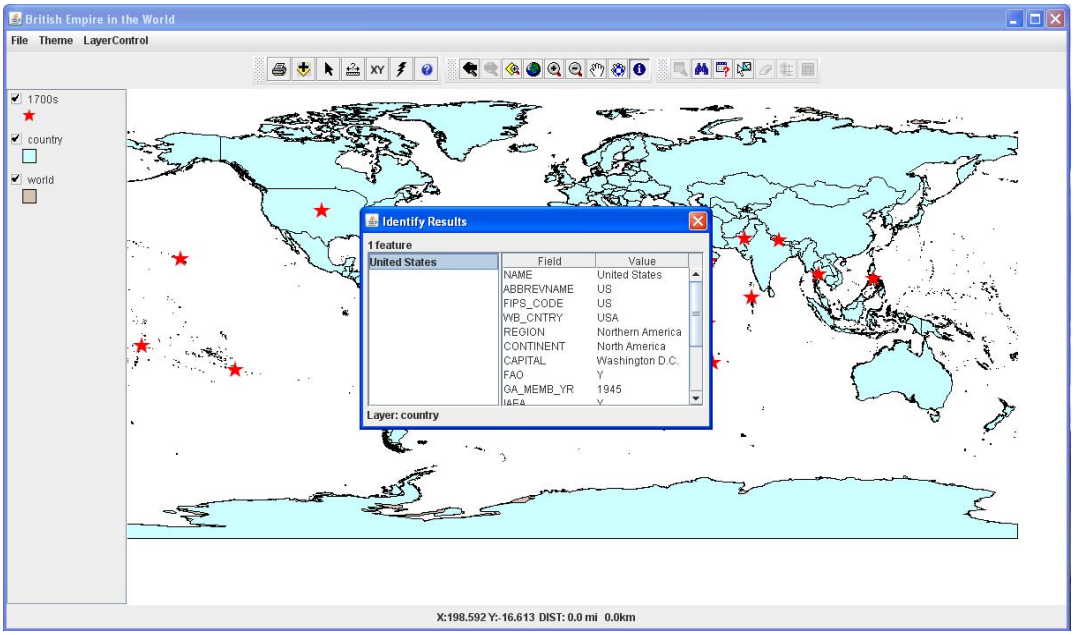

Figure 6.31. Screen shot of result of using Identify tool.

6.2.17 Find

This tool is used to do text search on any layer. To use this, select a layer on the left side and then click on the icon that is shown in the Figure 6.32. When you click on this button it will open a window where you can enter the text next to the value field and click on find. It will search the whole layer and displays any matches found. The value entered to search is case sensitive so you need to do text searches keeping case sensitive in mind. A screen shot of this can be seen in Figure 6.33.

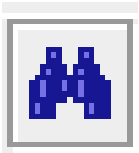

Figure 6.32. Find tool.

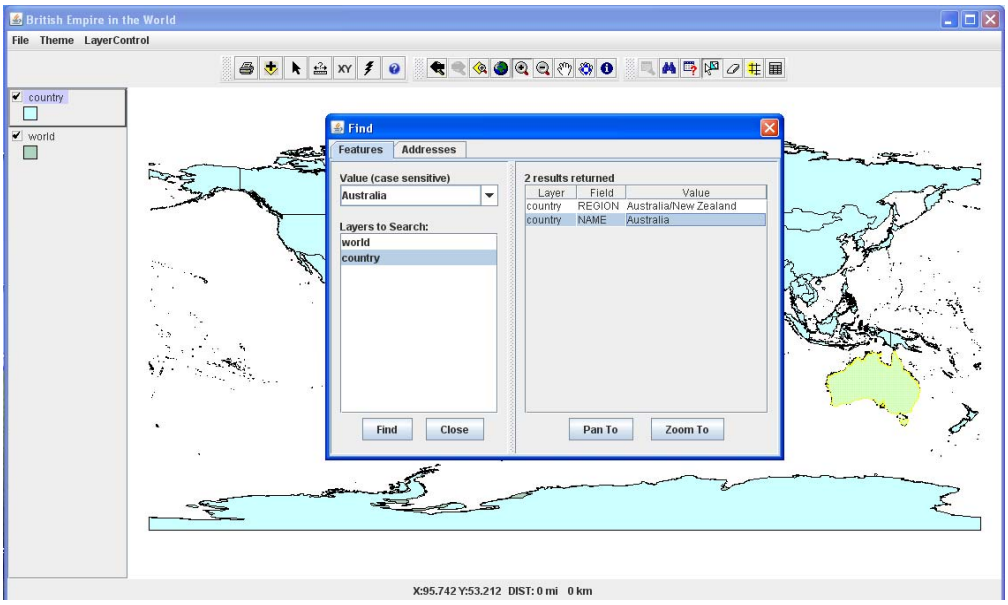

Figure 6.33. Screen shot of using Find tool.

6.2.18 Query Builder

Query Builder helps users to create SQL kind of queries and select certain features on the map. The icon for this is as shown in the Figure 6.34. Click on this icon and you will see query builder as shown in the Figure 6.35. Now you can build a query by selecting the fields or you can write your own query and click on execute. It will display the values returned in the query builder and also selects those areas on the map. The demonstration of this is shown in the Figure 6.36.

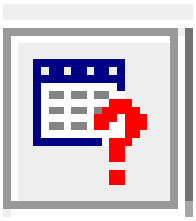

Figure 6.34. Query Builder.

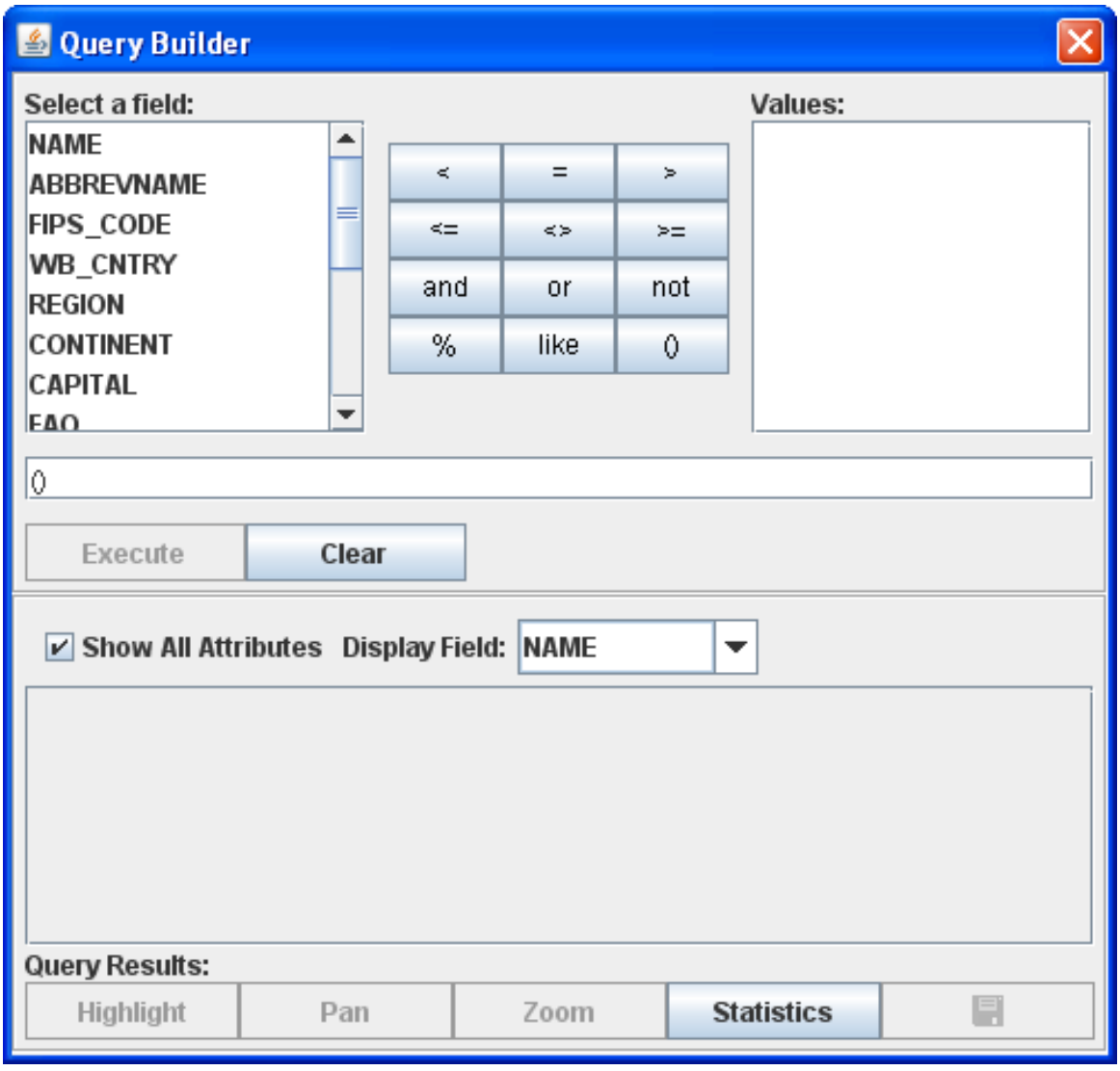

Figure 6.35. Query Builder dialog window.

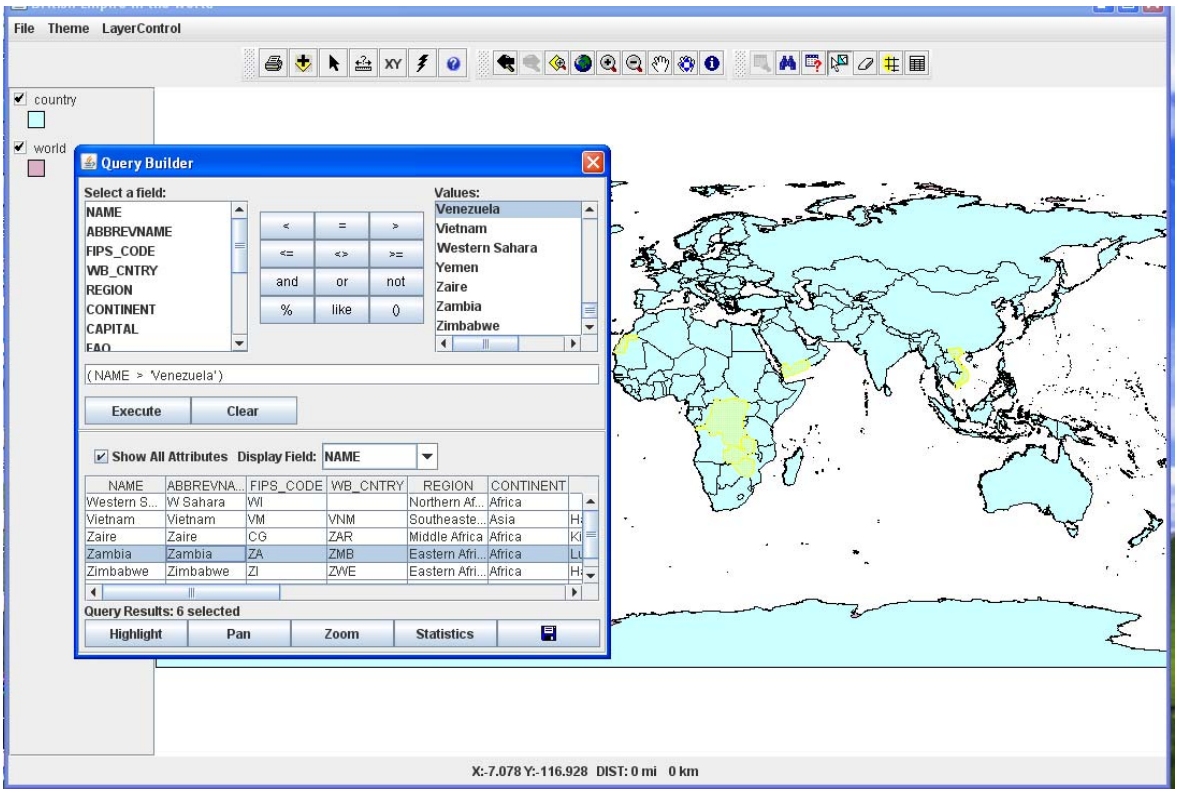

Figure 6.36. Illustration of using Query Builder.

6.2.19 Select Features

The icon to use this tool is as shown in Figure 6.37. To use this tool click on that icon and it will give four options rectangle, circle, polygon and line as shown in the Figure 6.38. Select any one of them. Now click on any area of the map which you want to select and it will turn into yellow bordered showing that you selected that area as shown in the Figure 6.39. You can select multiple areas by using the shift key.

6.2.20 Clear All Selection

The icon for this tool is as shown in the Figure 6.40. This tool is used to erase any features selected using the Select Features tool. This is grayed out as shown in Figure 6.41, if you did not make any selections using the Select Features tool. Now to erase the selection made in Figure 6.39, you simply click on this icon and the map will return to normal as shown in Figure 6.42.

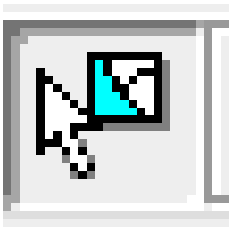

Figure 6.37. Select Features icon.

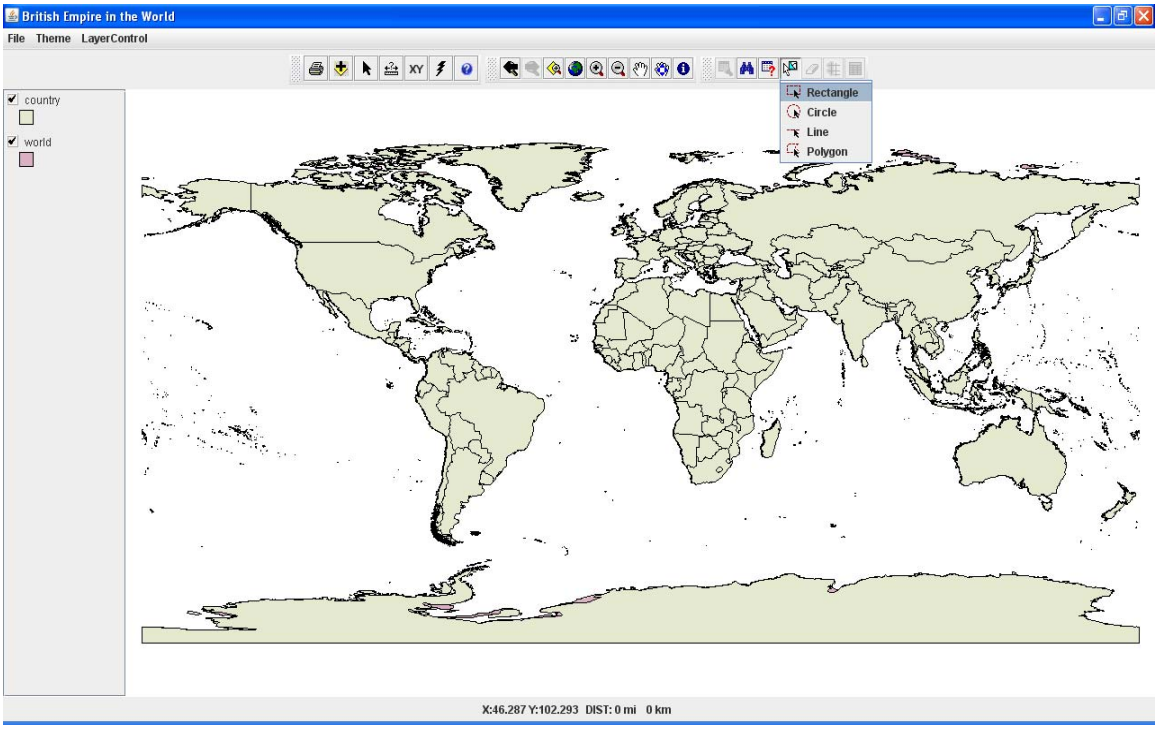

Figure 6.38. Showing the options of Select Features.

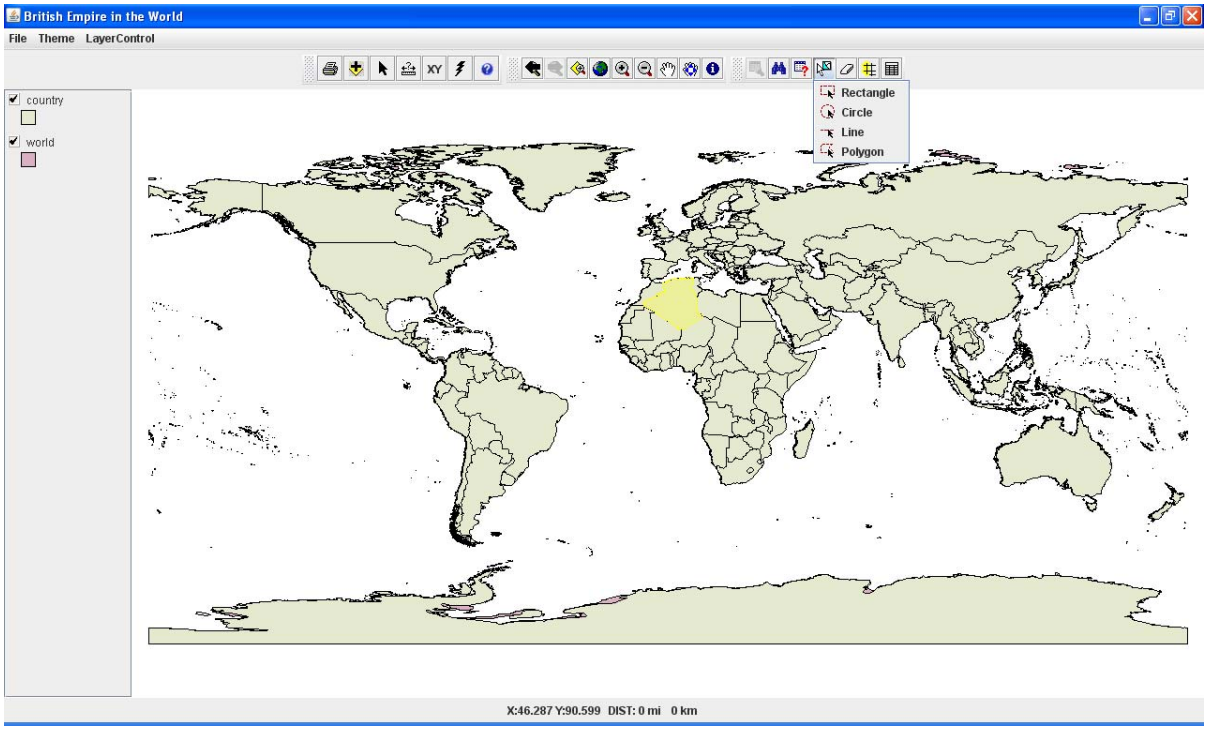

Figure 6.39. Select Features tool options.

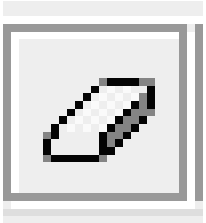

Figure 6.40. Clear All Selection icon.

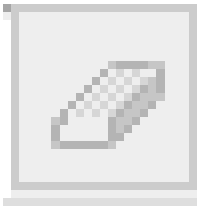

Figure 6.41. Clear All selection icon when grayed out.

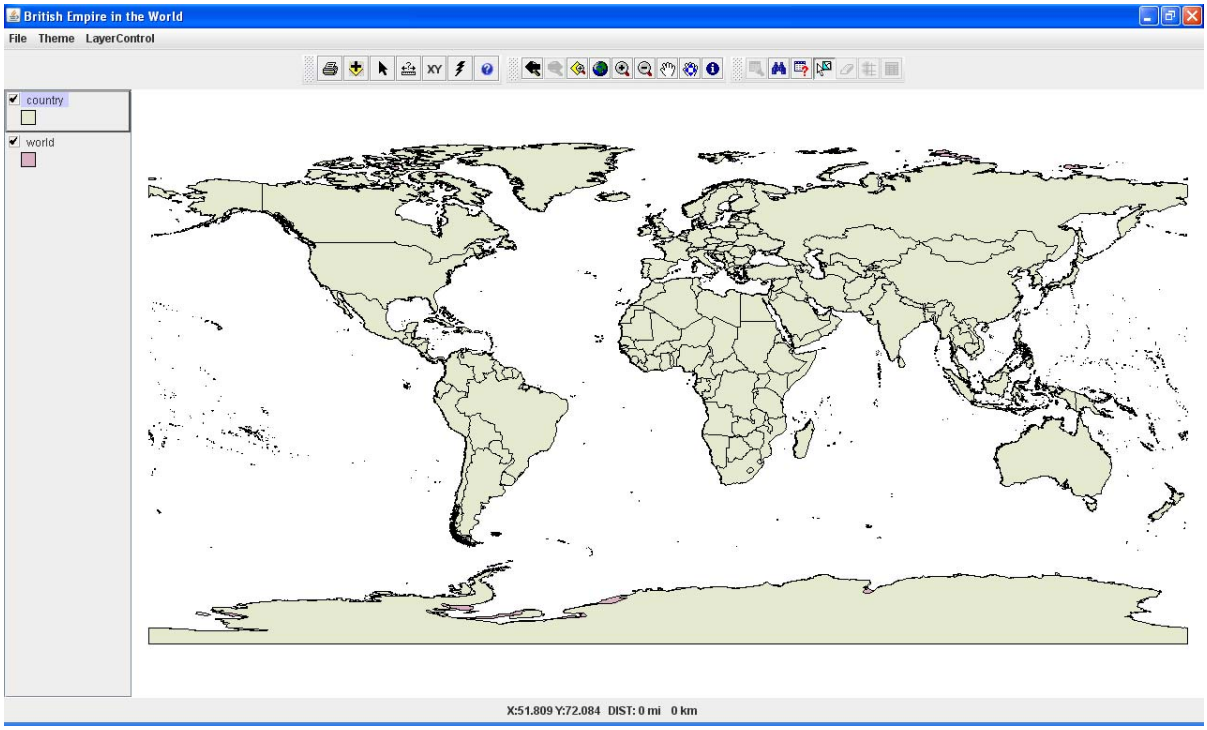

Figure 6.42. Map when cleared all selections.

6.2.21 Buffer

To enable this feature you need to select a layer on the left side and select any area on the map with the help of Select Features Icon shown in the Figure 6.37. When the feature is enabled the icon will be seen as shown in Figure 6.43 otherwise it will be grayed out as shown in the Figure 6.44. This tool is used to buffer the selected area along with the units selected in the buffer window. When you click on this, a window will be opened called Buffer as shown in the Figure 6.45. Give the Buffer distance and select the buffer units and then click on apply. You will see that the selected area is buffered. The demonstration is as shown in the Figure 6.46.

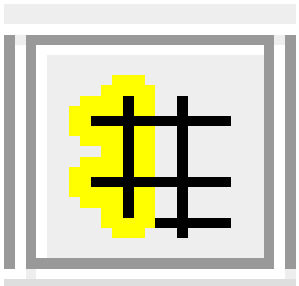

Figure 6.43. Buffer icon.

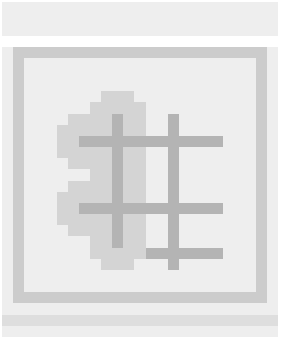

Figure 6.44. Buffer icon when grayed out.

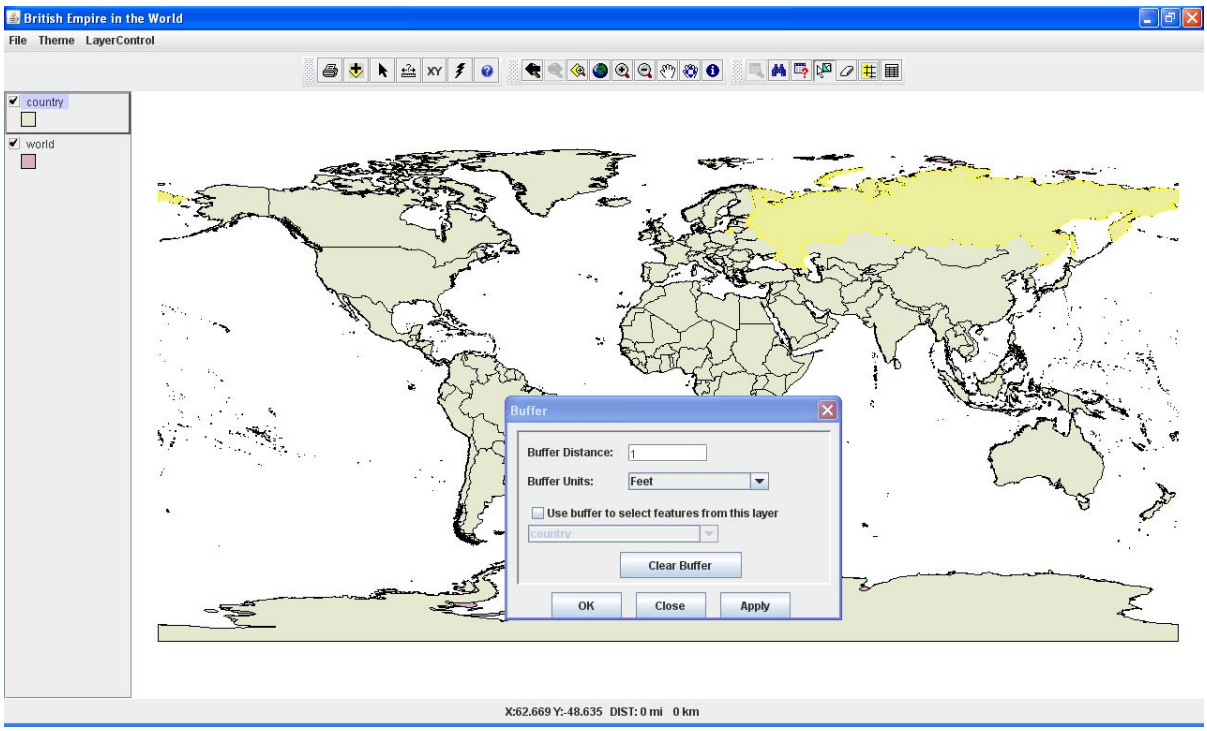

Figure 6.45. Screen shot of buffer window.

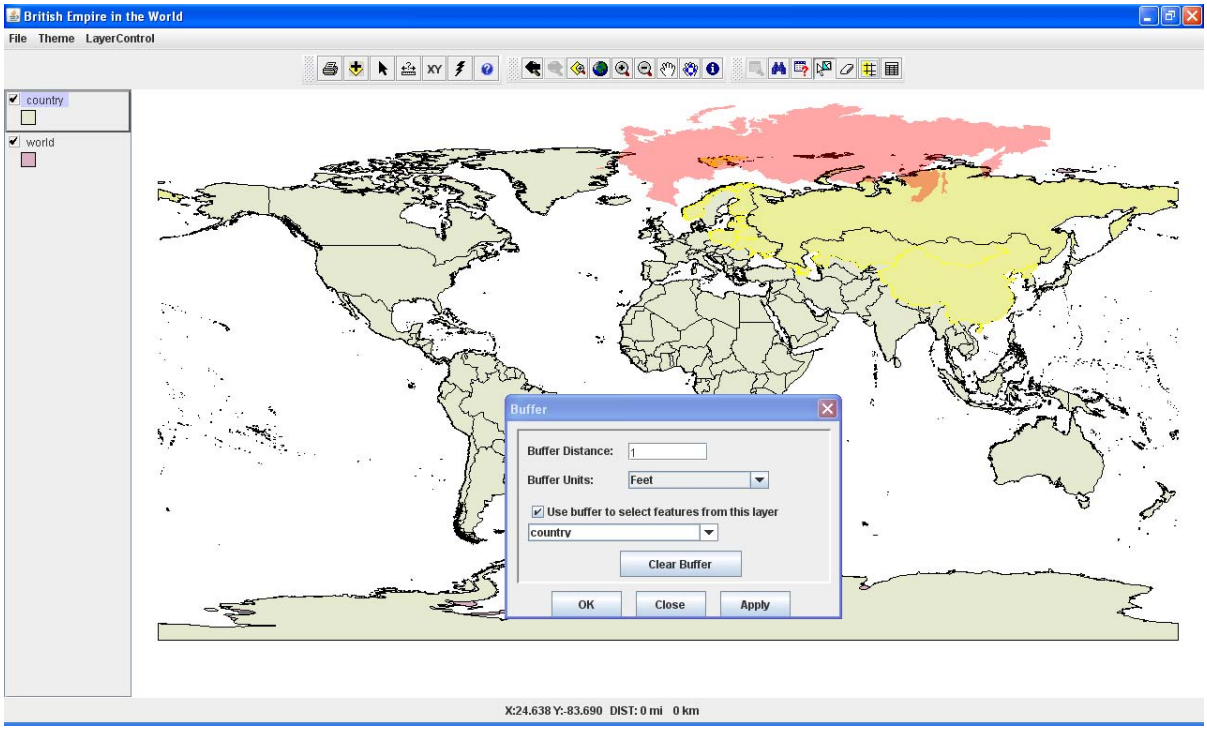

Figure 6.46. Demonstration of applying buffer.

6.2.22 Attributes

This tool is used to get the attributes for the selected areas made on selected layers. To enable this feature you need to select a layer on the left side and select any area on the map with the help of Select Features Icon shown in the Figure 6.37. When the feature is enabled the icon will be seen as shown in Figure 6.47, otherwise it will be grayed out as shown in the Figure 6.48. When you successfully made some selection as shown in the Figure 6.49, you will get the attributes window when clicked on this icon as you see in the Figure 6.49. This tool gets all the data at the same time.

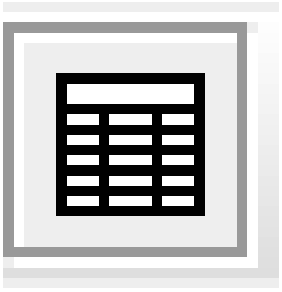

Figure 6.47. Attributes icon.

Figure 6.48. Attributes icon when grayed out.

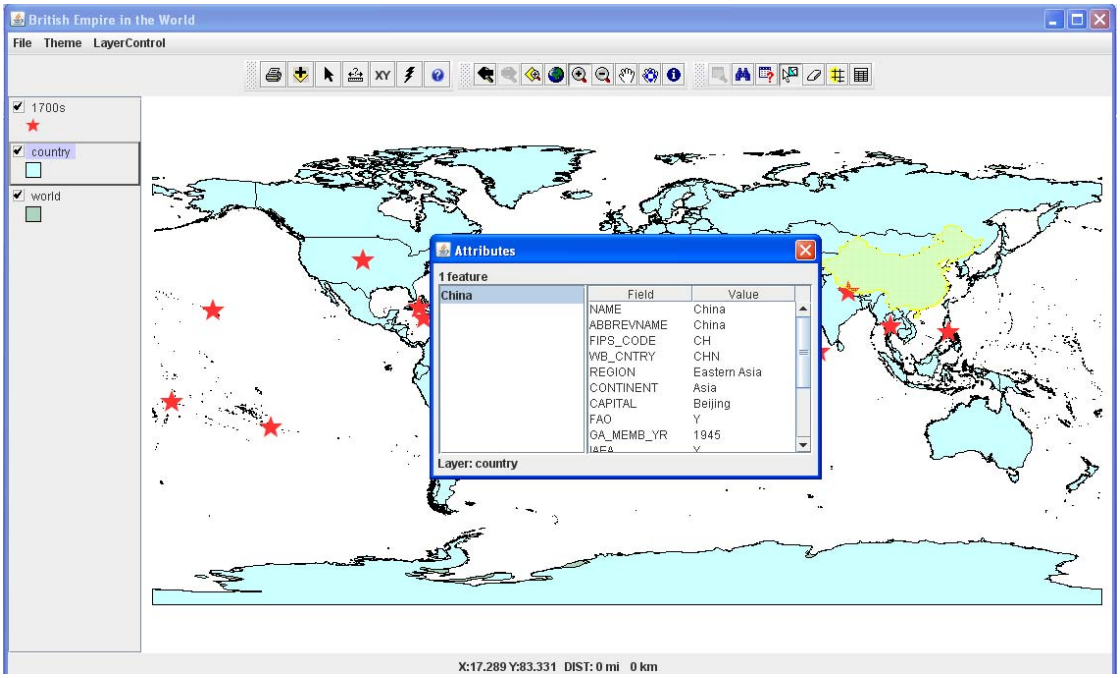

Figure 6.49. Screen shot using attributes feature.

6.3 MENU BAR

The Menu bar has four menus file, theme, layer Control and help. I will discuss each of these, their sub parts, functionality and how to use them. File, theme and layer control drop down options are shown in the Figures 6.50, 6.51 and 6.52 respectively.

Figure 6.50. File menu.

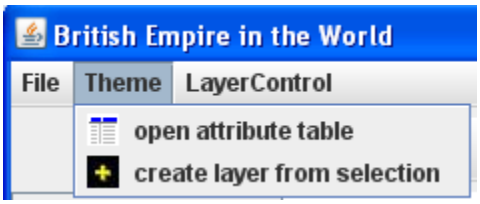

Figure 6.51. Theme menu.

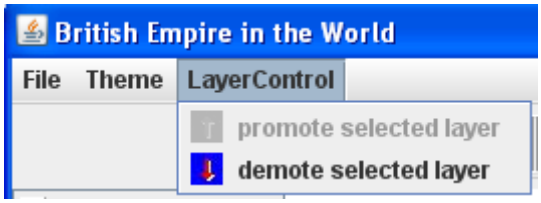

Figure 6.52. Layer Control menu.

6.3.1 Add Layer

Using add layer you can add a layer to the map by selecting a shape file from add layer dialog which opens when you click on the Add Layer. The add layer icon is as shown in the Figure 6.53. When you click on this Add Layer option the dialog window is opened which is shown in Figure 6.54. Now you can browse to C:\ESRI\MOJ20\Samples\ Data\World and select any shape file for example lakes.shp and then click on ok. Now the lakes layer is added to the map. The screen shot after adding lakes layer is as shown in the Figure 6.55. You can see that lakes are in blue color. You can also add images files to the map using this feature.

6.3.2 Remove Layer

Remove layer simply removes a layer from the map. The icon for remove layer is shown in the Figure 6.56. If you want to remove the lakes layer that we have added previously. Select the lakes layer on the table of contents i.e. on the left side of the map as shown in the Figure 6.57. After selecting the lakes layer only go to file menu and then click remove layer. Now the lakes layer is gone from the map.

6.3.3 Legend Editor

Using the editor we can change the color of the layers and we can add labels to the map. We can customize the font, size, orientation and color of the labels displayed on the

Figure 6.53. Add Layer icon.

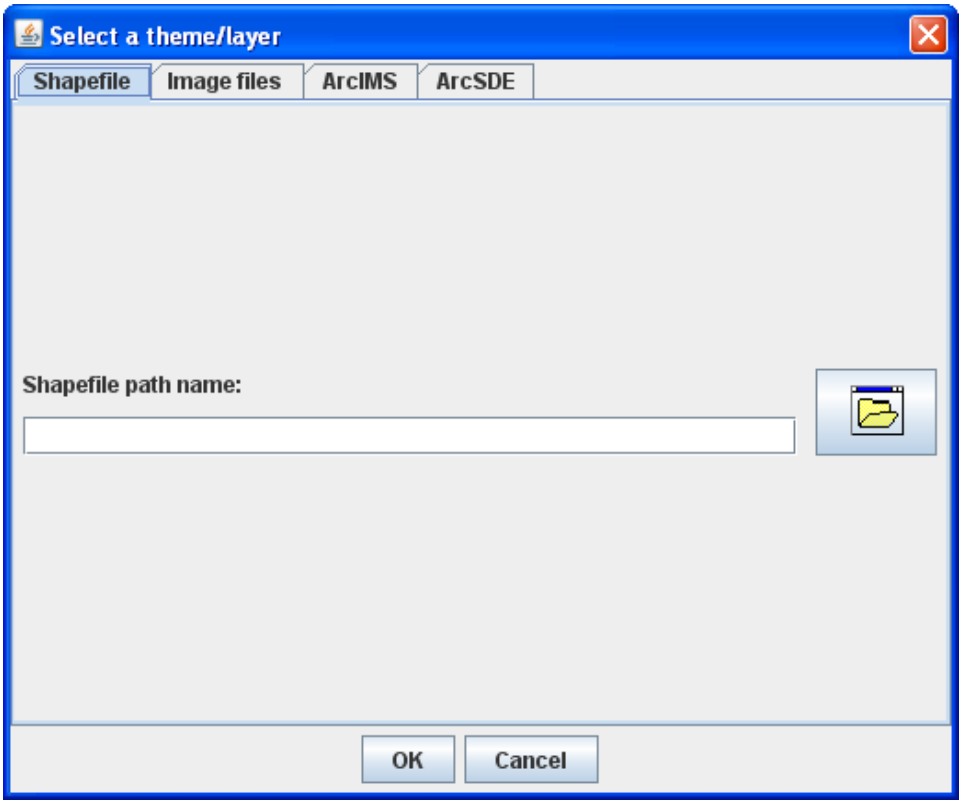

Figure 6.54. Add Layer Dialog window.

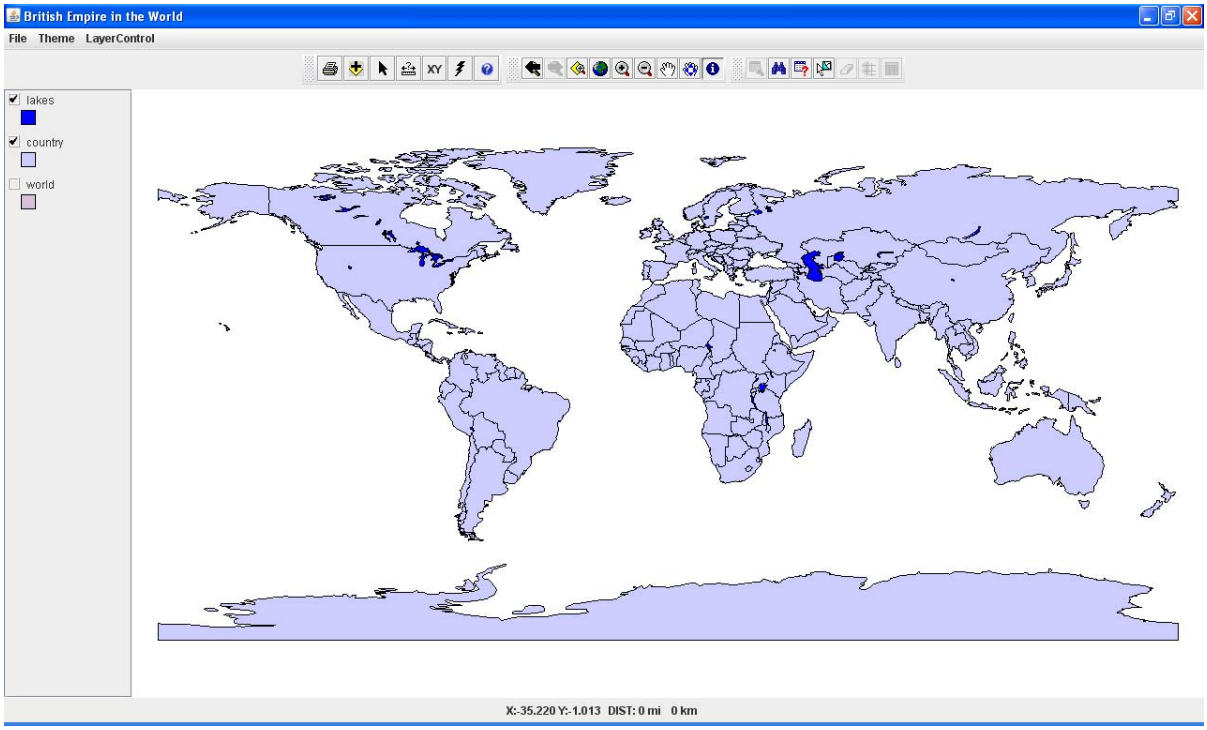

Figure 6.55. Map after adding lakes layer.

Figure 6.56. Remove layer.

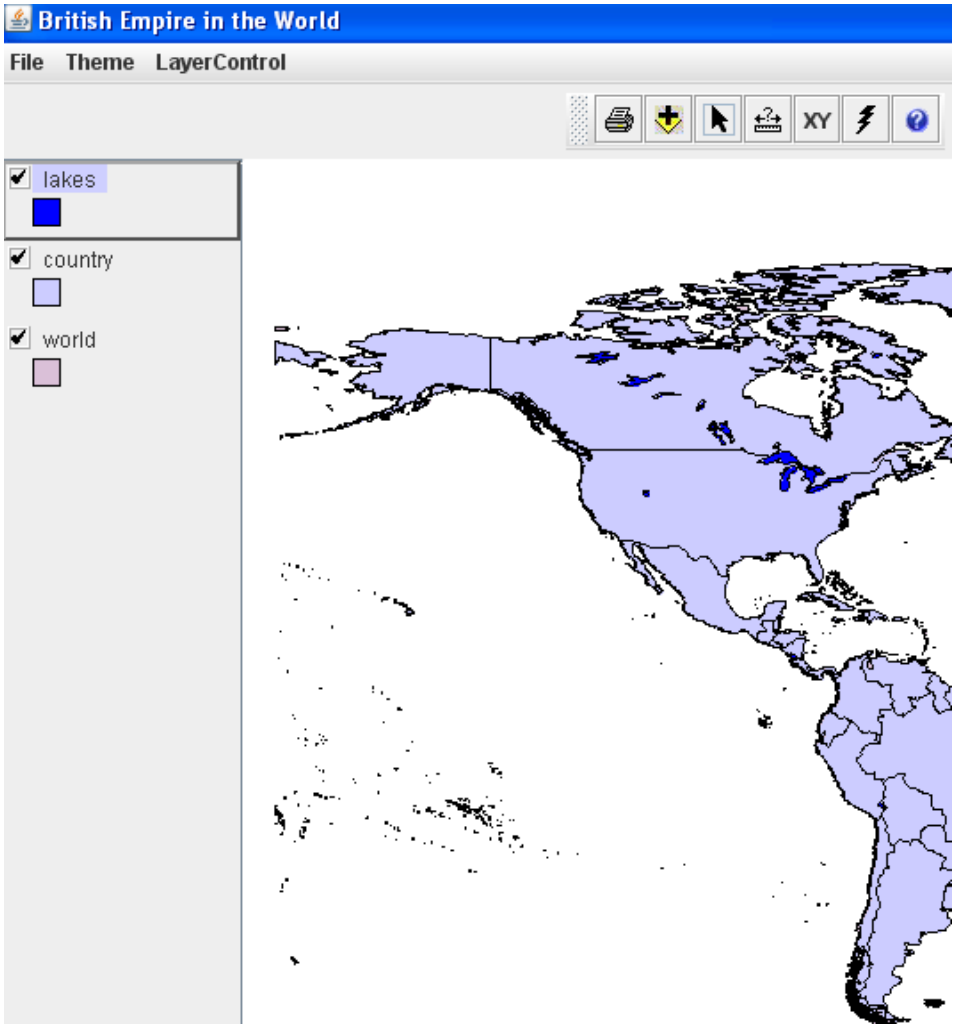

Figure 6.57. Screen shot showing lakes layer selected in the Table of Contents.

map. There are also other things that you can customize. I leave it to the users to play and learn. The icon for legend editor is as shown in the Figure 6.58. To use this feature, first you need to select a layer on the table of contents as shown in the Figure in 6.59. Now I want to change the color of the country layer on the map. As I selected that layer I will go to file menu and then click on the legend editor. Now it opens legend editor dialog window that is shown in Figure 6.60. I will go to color and then click on the drop down menu and then click on custom. It shows a color palette window as shown in Figure 6.61. Now I select some green color and then click on apply and then click ok. It now changes the color of the country layer to green as shown in Figure 6.62.

Figure 6.58. Legend Editor.

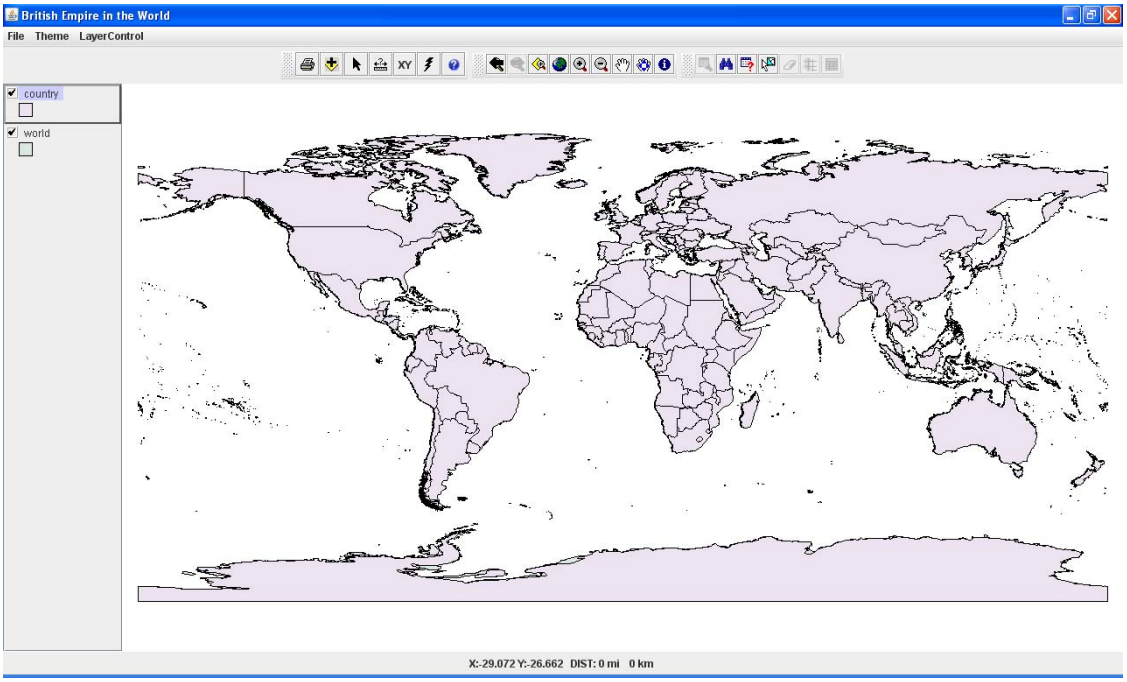

Figure 6.59. Map before changing the color.

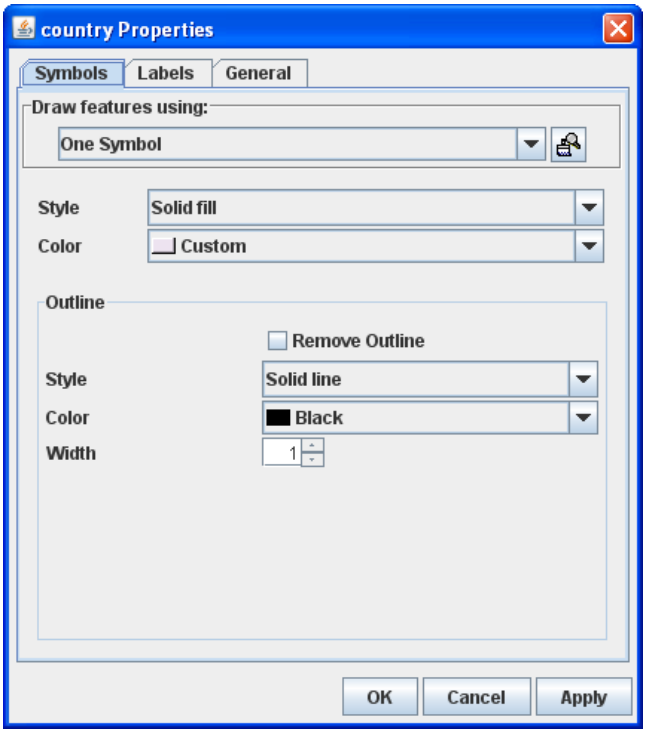

Figure 6.60. Legend Editor window.

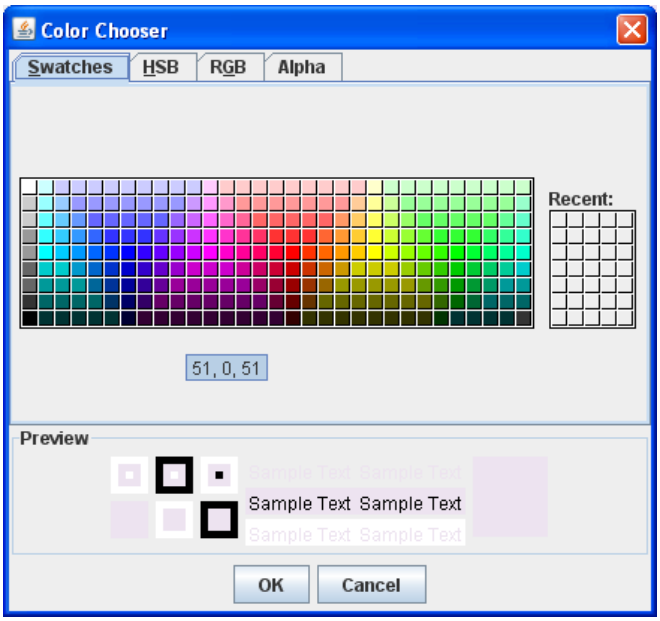

Figure 6.61. Color chooser.

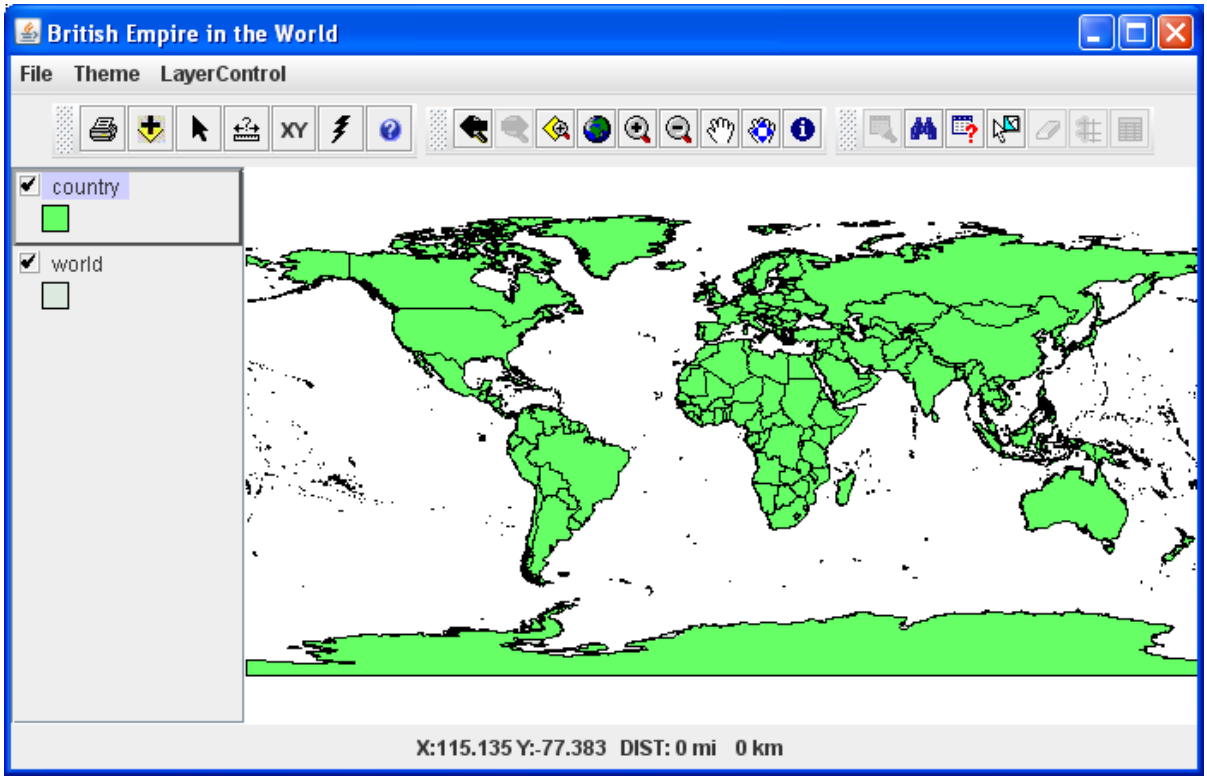

Figure 6.62. Map after changing the color using Legend Editor.

We will also see how to add labels to the map. To demonstrate this I will add my CSV files located at C:\ESRI\MOJ20\British Empire\dist with names 1700s.csv, 1800s.csv and 1900s.csv. To add these files I have used the XY button that is shown in Figure 6.15. After adding these files as layer the map looks like the Figure 6.63. To add labels I will select 1700s layer on the table of contents and click on the legend editor and then click on labels tab as shown in Figure 6.64. Now click on the drop down menu below labels feature using as shown in Figure 6.65. Then select the country and then click on apply and then click ok. Now you get the labels for that particular layer as shown in the Figure 6.66. You can also select font, size, orientation etc according to your convenience. Users can play with other options on the legend editor.

6.3.4 Attribute Table

An attribute table contains data about the layer that will be in the form of rows and columns. This attribute table is stored in the format of .dbf files. These files come along with shape files. The size of these depends upon the information they want to provide along with that layer. To see the attribute table, select a layer on the table of contents and then go to the theme menu and click on the open attribute table option that is shown in the Figure 6.67.

Here we have selected country layer and clicked on the open attribute table. The attribute table that we got is shown in the Figure 6.68.

6.3.5 Create Layer From Selection

Using this option you can create a new layer from the selections made on the map using the select features functionality which is in Figure 6.37. Make selections as explained in section 6.2.19 and as shown in Figure 6.39. The icon for this option is as shown in the Figure 6.69.

After selecting some areas on the map using the shift key and select features tool click on create layer from selection. It will show a prompt to click on and do it. It adds automatically a new layer to the map. We made some selections and created a layer on the map that you can see in Figure 6.70. You can change the name of the layer using the legend editor, which we discussed about earlier.

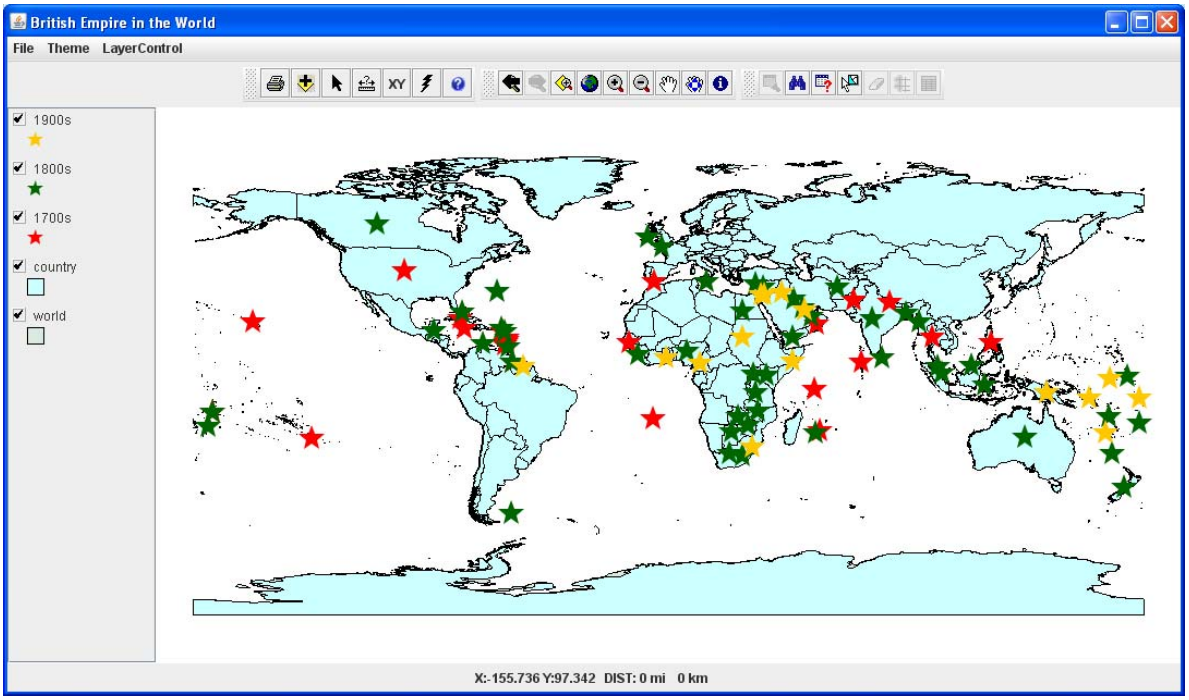

Figure 6.63. Map after adding CSV files of British Empire.

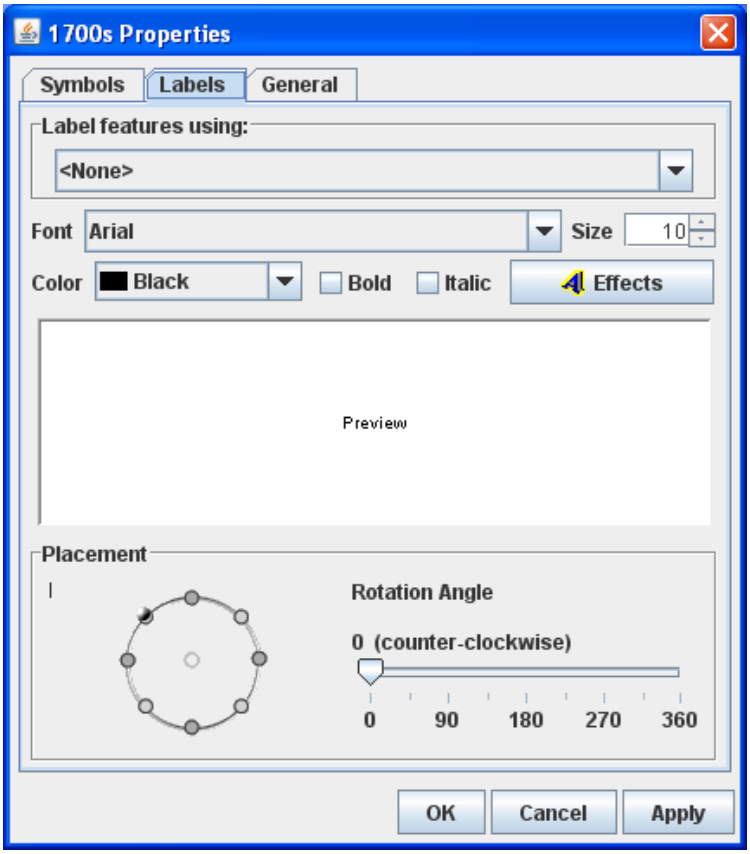

Figure 6.64. Legend Editor with Labels tab.

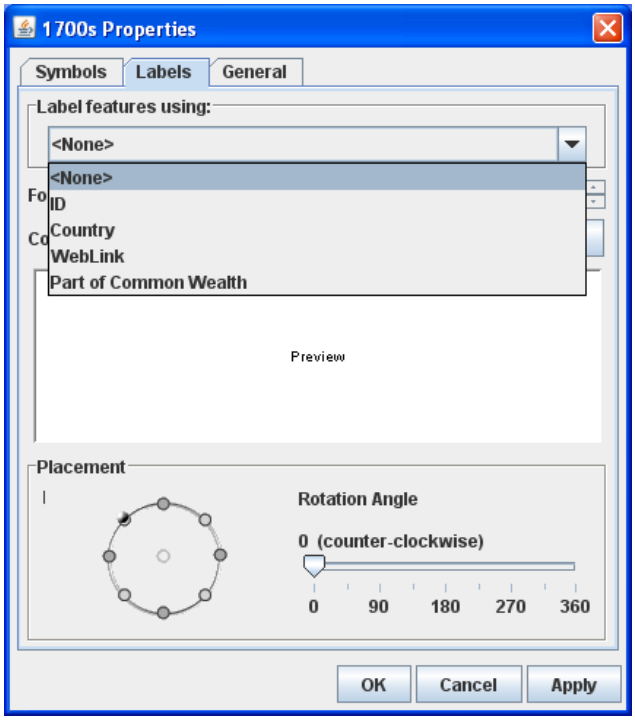

Figure 6.65. Labels feature using drop down menu.

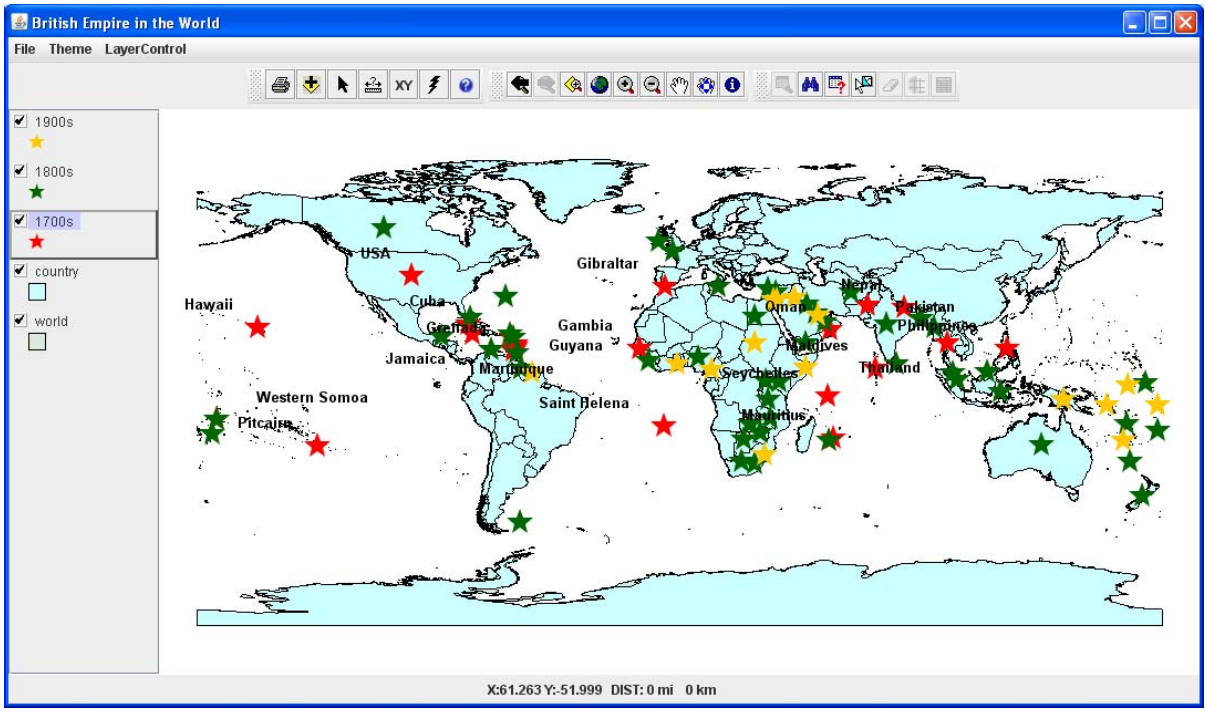

Figure 6.66. Map after adding labels to layer 1700s.

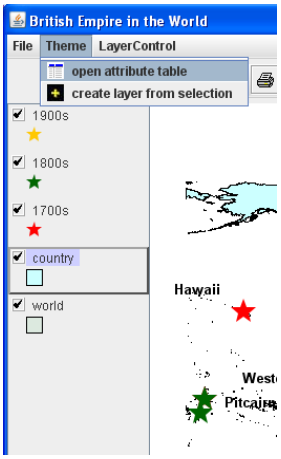

Figure 6.67. Open Attribute Table option from theme menu.

Attribute Table

#SHAPE#	NAME	ABBREVNA...	FIPS_CODE	WB_CNTRY	REGION	CONTINENT	CAPITAL
0	Luxembourg	Luxembourg	LU	LUX	Western E...	Europe	Luxembour
1	Switzerland	Switzerland	SZ	CHE	Western E...	Europe	Bern
2	France	France	FR	FRA	Western E...	Europe	Paris
3	Korea, Rep...	Korea Rep	KS	KOR	Eastern Asia	Asia	Seoul
4	Cyprus	Cyprus	CY	CYP	Western As...	Asia	Nicosia
5	Japan	Japan	JA	JPN	Eastern Asia	Asia	Tokyo
6	Bhutan	Bhutan	BT	BTN	Southern A...	Asia	Thimbu
7	Western S...	W Sahara	WI		Northern Af...	Africa	
8	Qatar	Qatar	QA	QAT	Western As...	Asia	Doha
9	United Ara...	Untd Arab ...	TC	ARE	Western As...	Asia	Abu Zaby
10	Taiwan	Taiwan	TW	OAN	Eastern Asia	Asia	Taipei
11	Mali	Mali	ML	MLI	Western Afr...	Africa	Bamako
12	Oman	Oman	MU	OMN	Western As...	Asia	Masqat
13	Niger	Niger	NG	NER	Western Afr...	Africa	Niamey
14	Chad	Chad	CD	TCD	Middle Africa	Africa	N'Djamena
15	Vietnam	Vietnam	VM	VNM	Southeaste...	Asia	Hanoi
16	Cuba	Cuba	CU	CUB	Caribbean	North Amer...	Havana
17	Laos	Laos	LA	LAO	Southeaste...	Asia	Vientiane

Figure 6.68. Attribute table for layer country.

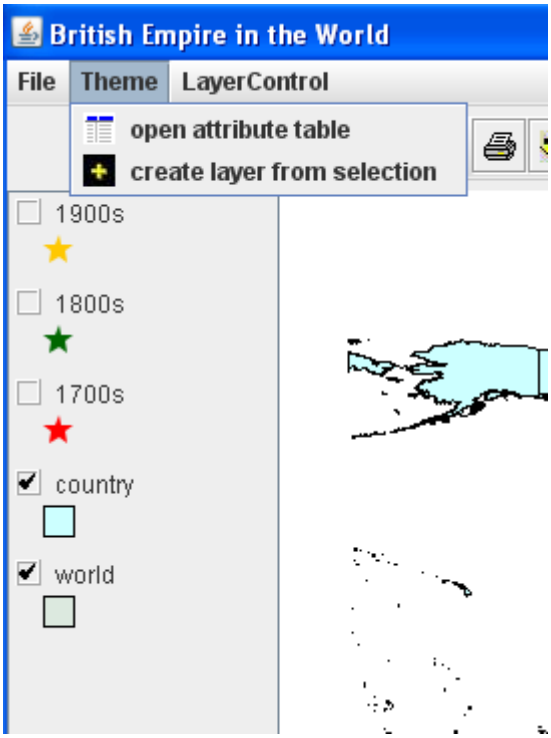

Figure 6.69. Create layer from selection.

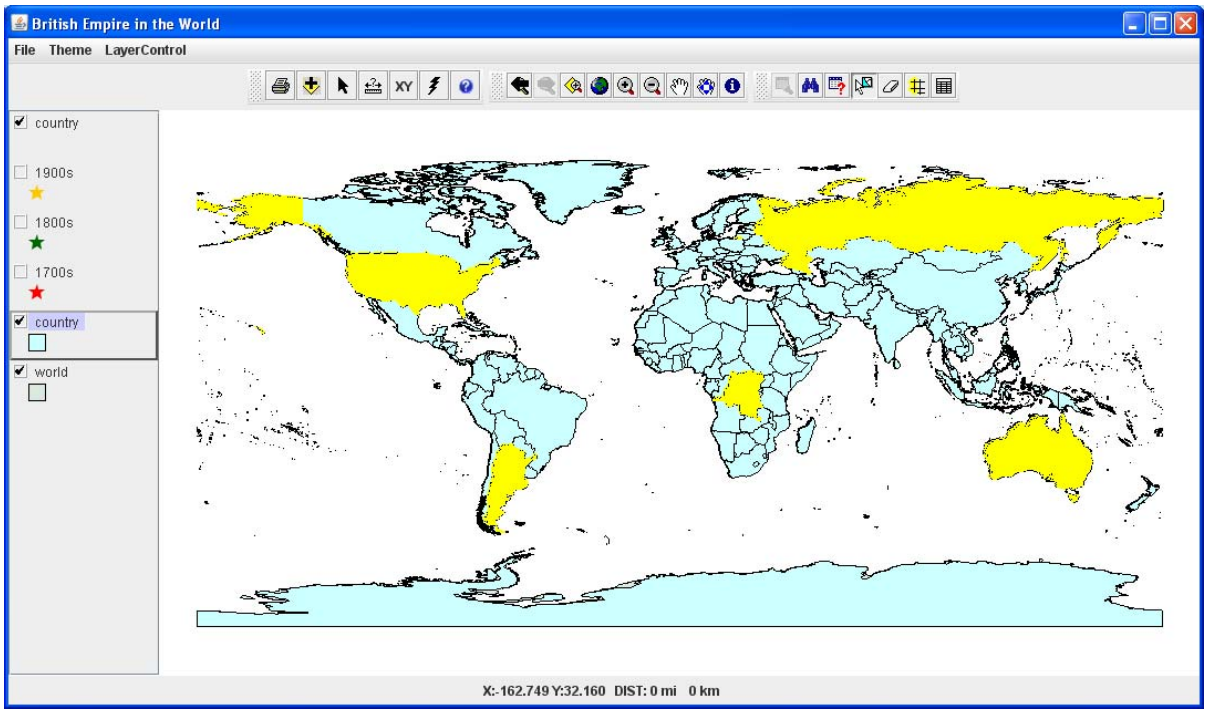

Figure 6.70. Screen shot of the map after creating a layer from selections made.

6.3.6 Promote Or Demote Selected Layer

Using these options that are present under the menu layer control as shown in Figure 6.71 we can change the order of layers displayed on the map. Now if I want to move the layer 1700s to bottom of the TOC (Table of Contents), simply select that layer and click on demote layer until its position is changed to last one in the table of contents as shown in Figure 6.72. Now if you observe you cannot see some of the red stars as they are hidden below the other layers. Now if you want to move the 1700s layer to the top so that you can see all the red stars. Use the promote layer option in the same way as demote layer. Also you can make layers visible or invisible on the map area by checking or unchecking the layers in the table of contents. I unchecked the layers 1700s, 1800s and 1900s as shown in the Figure 6.73 an you can observe that the stars are gone in the map area.

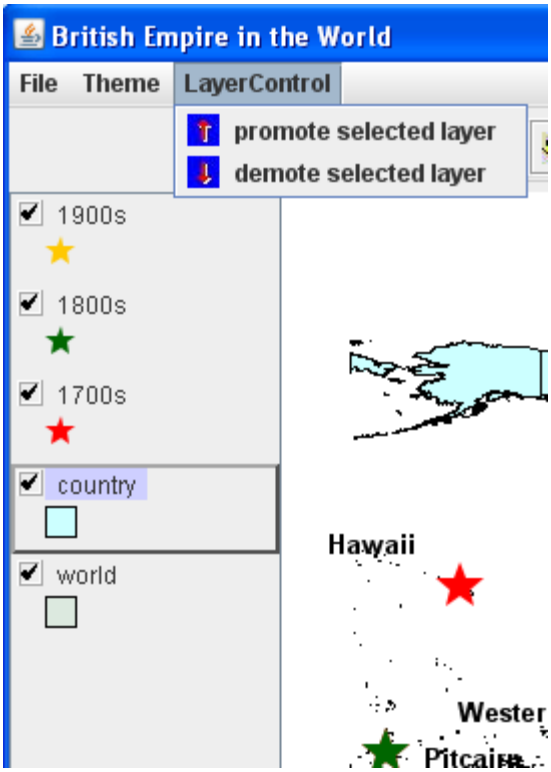

Figure 6.71. Layer Control Options.

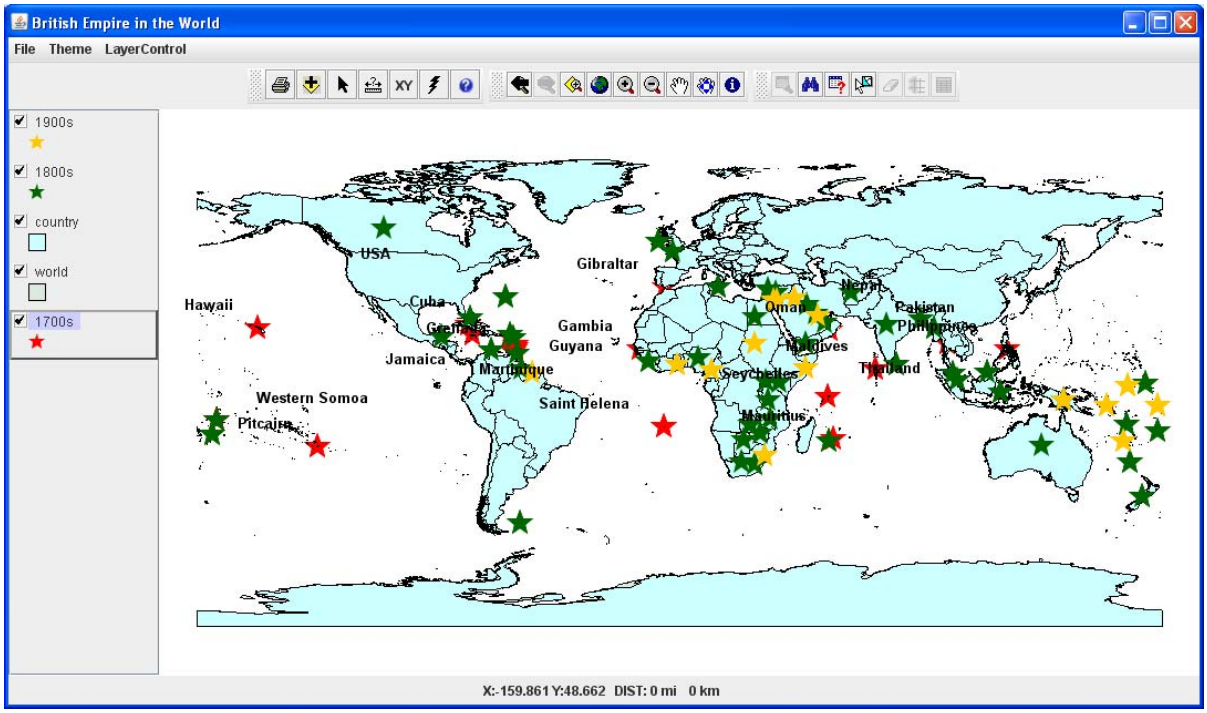

Figure 6.72. Moved Layer 1700s all the way to bottom.

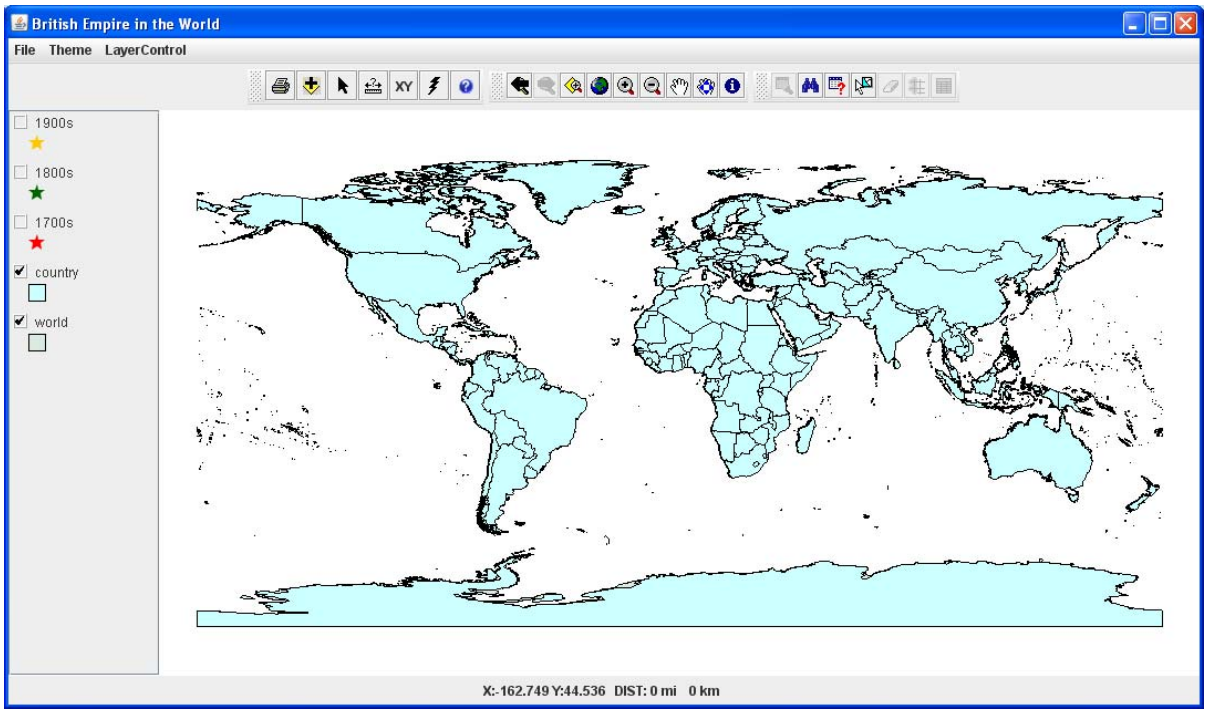

Figure 6.73. Some layers unchecked in the table of contents.

CHAPTER 7

CONCLUSION

This thesis is about building a teaching aid tool for the British Empire for department of history. Dr. Carl Eckberg and Dr. Edward Beasley played very important roles in shaping up this software. The whole point of building the software is to satisfy the customers ultimately. All the software requirements were not given at one time. Requirements were given or changed every time there was a review about the software which is planned to be interactive way. So lot of time has been spent upon building the software until the customers are satisfied with the project.

As the British Empire is so vast and topic is about the whole world, there was lot of data to be collected about so many countries. It took very long time for collection of data and preparing the data. As the requirements were changing, it took lot more time to collect the data. First it took time to know which countries the British ruled. After preparing the list of countries that were ruled by the British then data about each country has been collected. The data collection included start of the British rule in that country, year of independence, commonwealth of nations or not, flags, important movements, important wars, any images related to the British Empire in that country, videos etc.

Coming to the challenges faced on the technical side, first as I was not proficient in java and it took some time to get started with the development. As one of the requirements was easy installation of the software, NetBeans was used. NetBeans was completely new to me and it took time to configure the map objects in NetBeans. Then making the hotlink cursor work properly and opening the html links in any available internet browser on any type of machine were some of the challenges faced in development of the software.

Lot of things were learnt from the thesis. Got hands on experience with Java, NetBeans, Map Objects that are helpful for my career in this competitive world. Also got experience working on the ArcGIS Desktop application, one of the challenging and interesting environments.

CHAPTER 8

FUTURE ENHANCEMENTS

This GIS tool is built using Map Objects Java and Java Swings, so adding additional features or modifying the features can be comfortably done with this software. Most of the code contains java classes and these classes can be reused or extended easily. It is also easy to write new classes using Java. Some of the ideas that can be considered for future enhancements are:

1. This software is developed only for the British Empire, but it can be extended to be generic to teach any world history like the Russian Empire, the Ottoman Empire, the French Colonial Republic, etc. It is only that collection of data and preparation of CSV files matters.
2. Ability to let the user give coordinate and information and then automatically adding that as a point on the map.
3. Coloring the countries map area in different colors for each category.
4. Adding additional CSV files for country capitals, major rivers or ports, key battles, etc.
5. Adding self-test quizzes.
6. Adding dynamic map based games.

BIBLIOGRAPHY

WORKS CITED

[1] *About shapefiles dBase tables, and file types*. ESRI, http://webhelp.esri.com/arcgisdesktop/9.3/index.cfm?TopicName=About_shapefiles,_dBASE_tables,_and_file_types, accessed January 2011, Nov. 19, 2008.

[2] *Abstract window toolkit*. Wikipedia, http://en.wikipedia.org/wiki/Abstract_Window_Toolkit, accessed January 2011, n.d.

[3] *British Empire*. Wikipedia, http://en.wikipedia.org/wiki/British_Empire, accessed September 2010, n.d.

[4] *BritishEmpire-Help*. Wikispaces, http://britishempire-help.wikispaces.com, accessed May 2010, n.d.

[5] *ESRI Shapefile technical description*. ESRI, http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf, accessed January 2011, Jul. 1998.

[6] D. Falkman, *Review: ESRI MapObjects Java edition 2*. Java boutique, http://javaboutique.internet.com/reviews/ESRI/, accessed January 2011, n.d.

[7] *Learn about Java technology*. Java, http://www.java.com/en/about/, accessed January 2011, n.d.

[8] *Links for Victorian studies*. Empiretheory.fortunecity.net, http://empiretheory.fortunecity.net/VictorianLinks.htm, accesses October 2010, n.d.

[9] Environmental Systems Research Institute, Inc. *MapObjects Java Edition 2.0.1 programmer's reference help*, n.d.

[10] *NetBeans IDE 6.1 information*. NetBeans, http://netbeans2.org/community/releases/61/index.html, accessed January 2011, n.d.

[11] *NetBeans IDE 6.9.1 download*. NetBeans, http://netbeans.org/downloads/index.html, accessed February 2011, n.d.

[12] *New to Java programming*. IBM, http://www.ibm.com/developerworks/java/newto/, accessed January 2011, n.d.

[13] L. Starr, *GIS brings "real life" to learning*. Education World, http://www.educationworld.com/a_tech/tech/tech186.shtml, accessed January 2011, Apr. 23, 2009.

[14] *The British Empire*. Britishempire.co.uk, http://www.britishempire.co.uk, accessed August 2010, n.d.

[15] *Top reasons to switch to the NetBeans IDE*. NetBeans, http://netbeans.org/switch/why.html, accessed February 2011, n.d.

[16] *Welcome to the BritishBattles.com web site*. BritishBattles.com, http://www.britishbattles.com/, accessed February 2011, n.d.

WORKS CONSULTED

C. Eckberg, *Notes on Map Objects – Java edition*, Handout CS537, San Diego State University, San Diego, CA, 2007.

Bare Bones browser launch for Java. Centerkey, http://www.centerkey.com/java/browser/, accessed June 2010, n.d.

Welcome to Wikipedia. Wikipedia, http://en.wikipedia.org/, accessed August 2010, n.d.

The Java Tutorials. Oracle, http://download.oracle.com/javase/tutorial, accessed June 2010, n.d.

Java Swing tutorial. Java, http://www.javabeginner.com/java-swing/java-swing-tutorial, accessed June 2010, n.d.

Member States. Commonwealth Secretariat, http://www.thecommonwealth.org/Internal/191086/142227/members/, accessed June 2010, n.d.

APPENDIX

USER MANUAL

A.1 INSTALLATION OF THE TOOL

The following are the steps to be followed to install the tool:

- Install JDK6 or higher version from the link:

  http://www.oracle.com/technetwork/java/javase/downloads/index.html
- Unzip the downloaded file using any zip utility software like WinZip, WinRar, 7zip etc.
- [Installation directory] is defined to be the folder that contains this tool.

A.2 LAUNCHING THE TOOL

Double click on "[Installation Dir]\BritishEmpire.jar" as shown in Figure A.1.

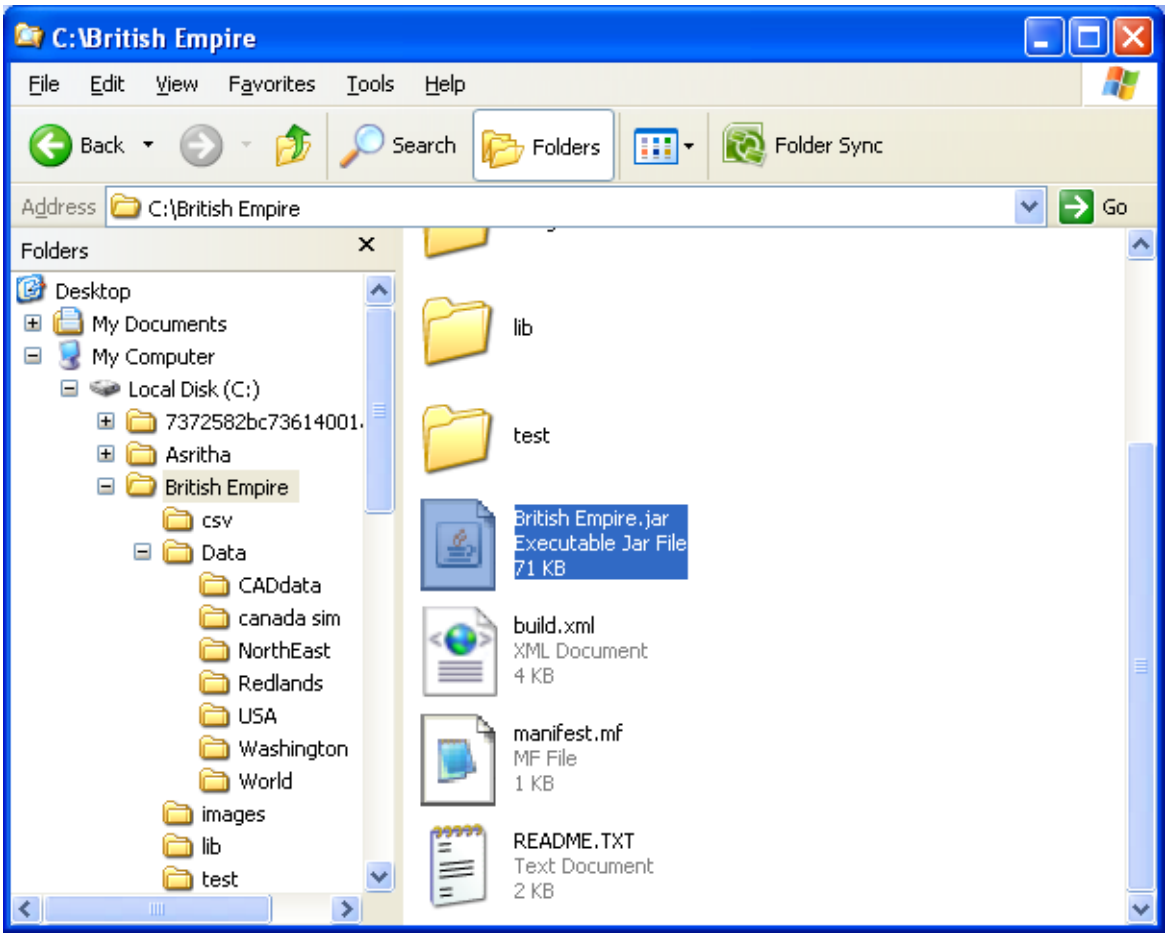

Figure A.1. Launching the tool.

If installed correctly, this should launch the tool and the following home screen comes up as shown in Figure A.2.

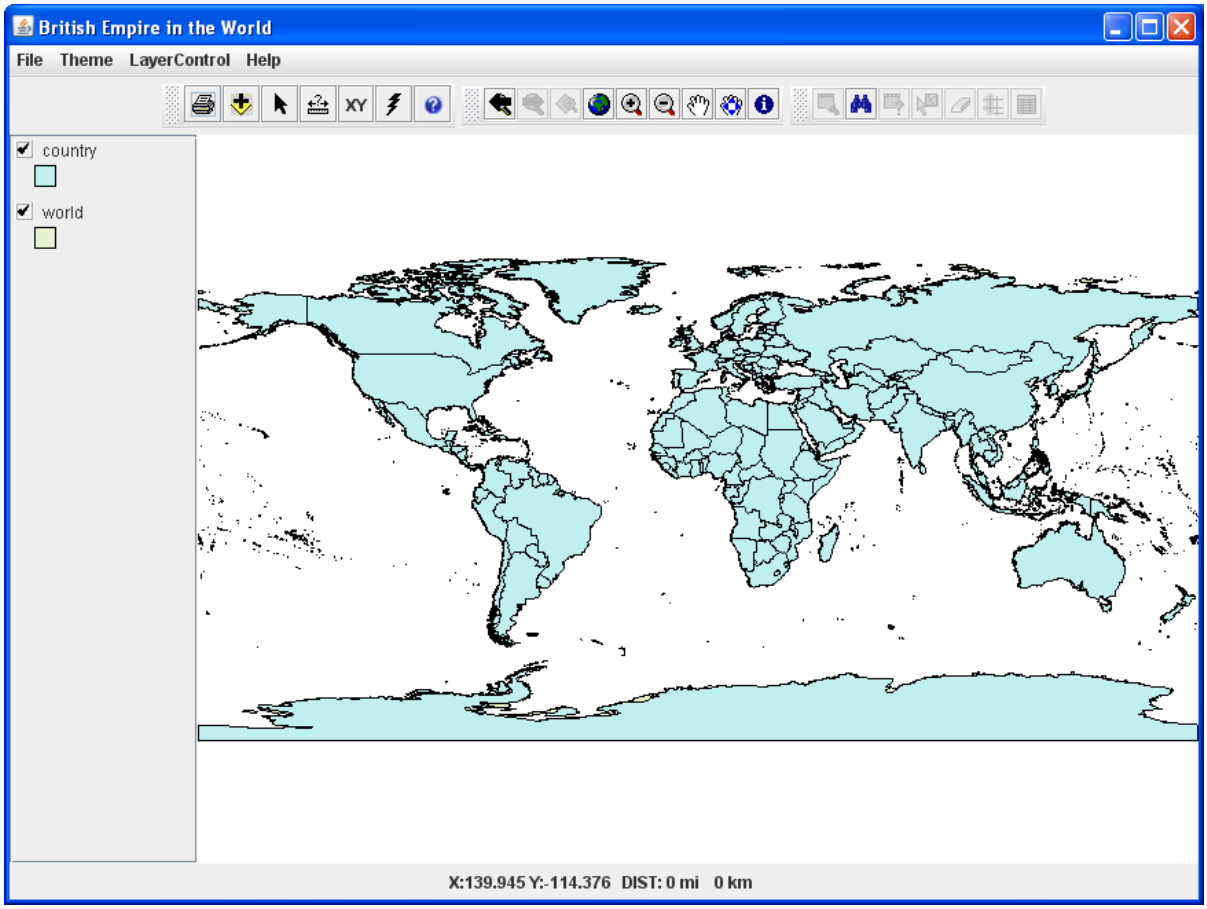

Figure A.2. Initial screen of the tool.

A.3 ADDING CSV FILES

To add CSV files on the map as hotspots/stars, you have to first click on the "XY" button as shown in Figure A.3.

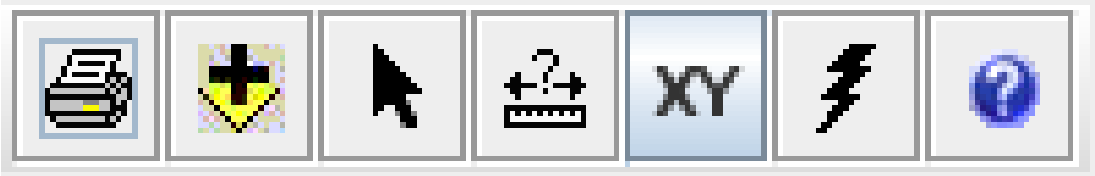

Figure A.3. XY Button highlighted.

You will get a file browser to select the CSV files as shown in Figure A.4.

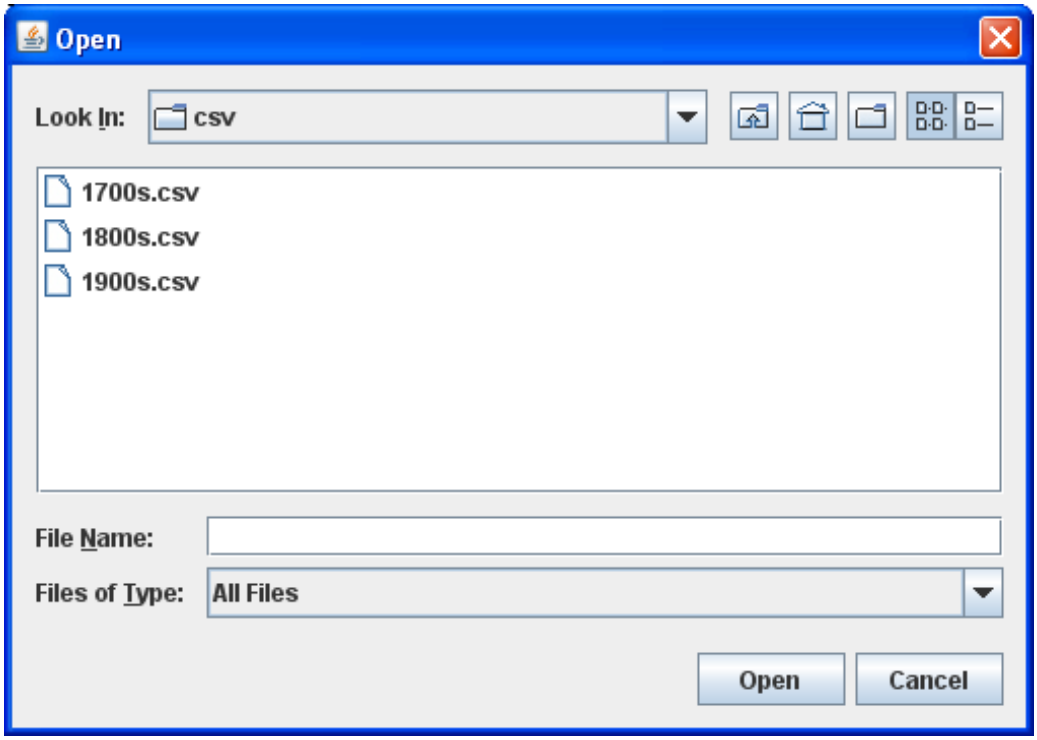

Figure A.4. File browser to select CSV files.

Select each one of them at a time and then click on open. The XY layer should have been added to the map with the hotspots contained in the CSV file. After adding all the CSV files you will get the map screen as shown in Figure A.5.

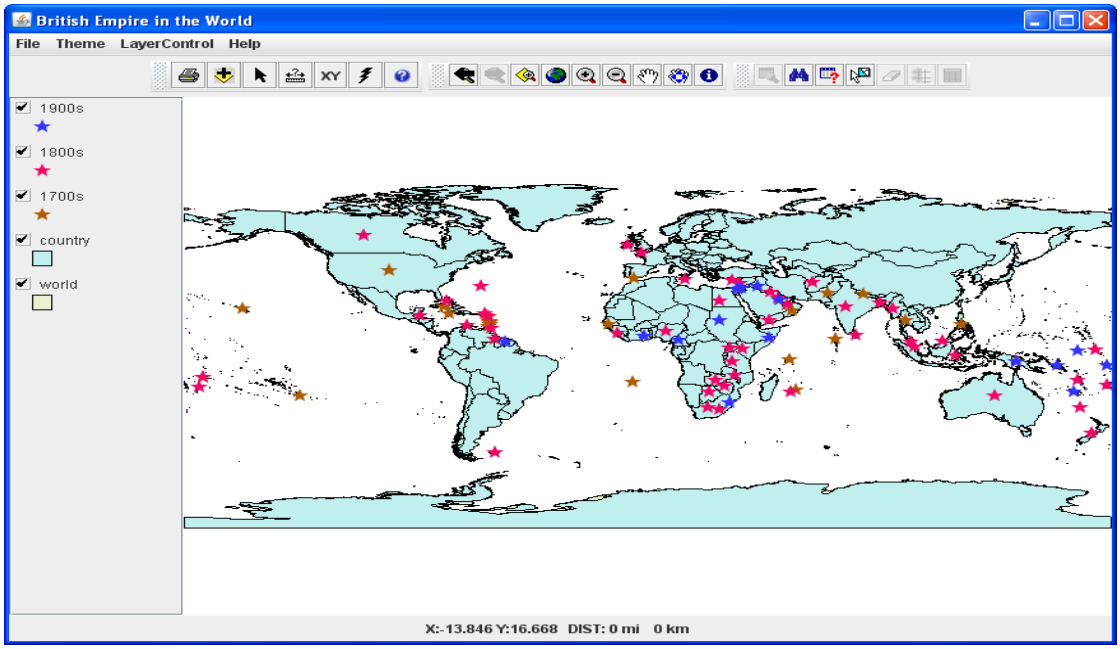

Figure A.5. Map screen after adding the layers.

A.4 Adding Labels to The Layers

Using the legend editor we can change the color of the layers and we can add labels to the map. We can customize the font, size, orientation and color of the labels displayed on the map. There are also other things that you can customize. I leave it to users to play and learn. To use the legend editor, first select a layer on the left side of the map to label that layer as shown in the Figure A.6.

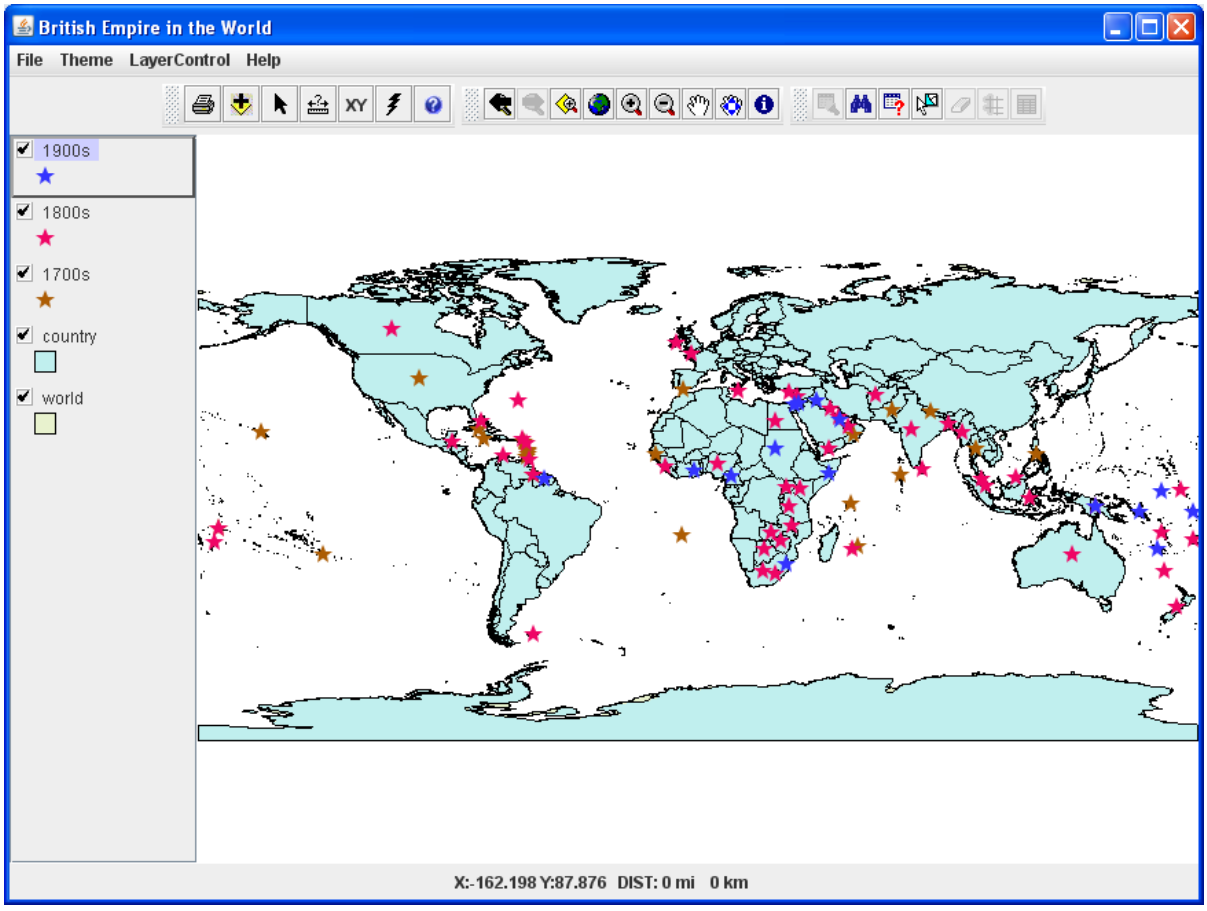

Figure A.6. Map screen showing 1900s layer selected on the table of contents.

Now go to File->Click on Legend Editor as shown in the below Figure A.7.

Figure A.7. Clicking on the Legend Editor.

When you click on the legend editor, you will get the window shown in the Figure A.8.

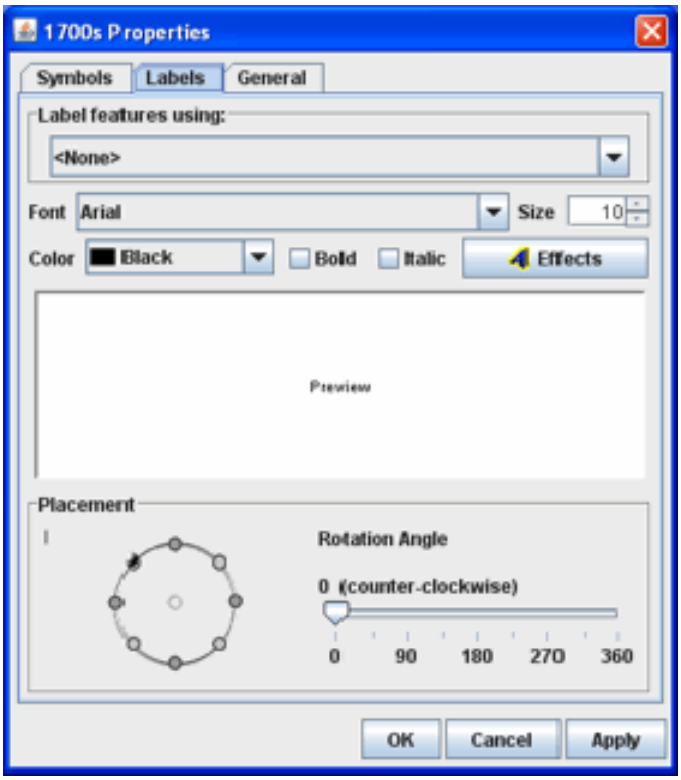

Figure A.8. Legend Editor Window with Labels Tab.

To set the labels, click on labels tab as shown in Figure A.9.

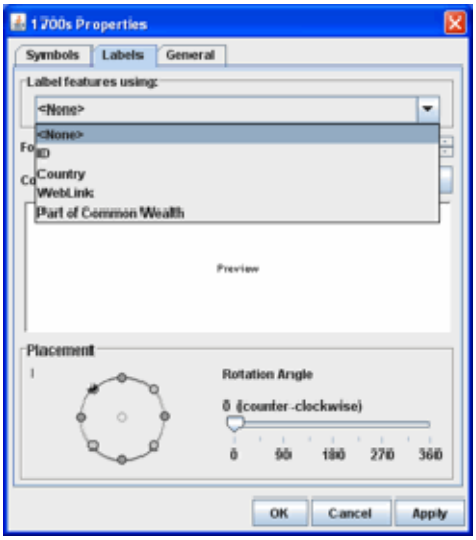

Figure A.9. Labels feature using drop down menu.

Now select the country and then click apply and click ok, you will get the labels as shown in the Figure A.10. You can do the same thing for other layers.

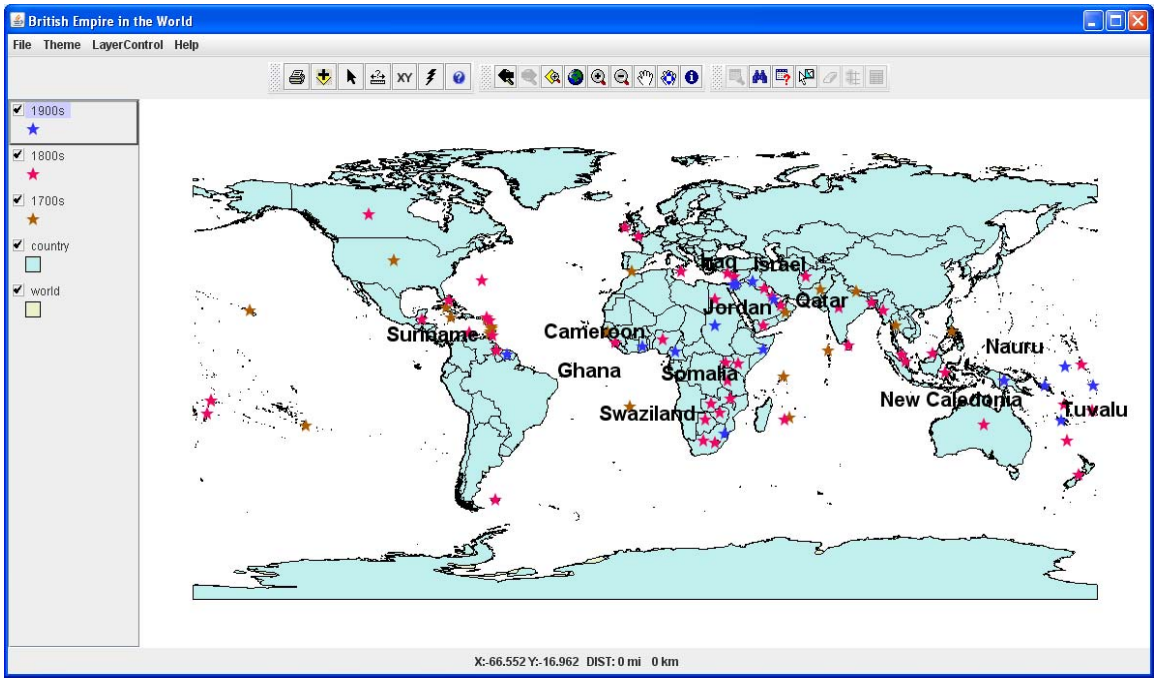

Figure A.10. Map after adding labels to 1900s layer.

A.5 Getting To The Help Page

Go To the help menu as shown in the Figure A.11 and click on them to get to the respective help pages.

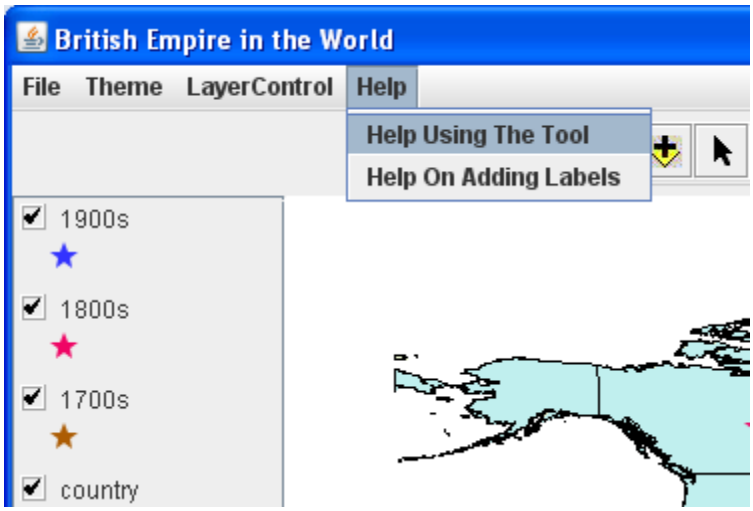

Figure A.11. Clicking on the help menu.